

# Global EMC Inc. Labs

## EMC & RF Test Report

As per  
**GLOBAL EMC**  
RSS 210 Issue 8:2010  
&  
FCC Part 15 Subpart C:2010  
Unlicensed Intentional Radiators  
on the

**In-Home Display 900MHz Module**

*Raymond Lee Au*

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Testing produced for  
**AzTECH**  
ASSOCIATES INC.

See Appendix A for full customer & EUT details.



Client	Aztech Associates Inc
Product	In-Home Display 900MHz Module
Standard(s)	RSS 210 Issue 8:2010 / FCC Part 15 Subpart C 15:2010



## Table of Contents

Table of Contents.....	2
Report Scope.....	3
Summary .....	4
Test Results Summary .....	5
Justifications, Descriptions, or Deviations.....	6
Applicable Standards, Specifications and Methods.....	7
Sample calculation(s).....	8
Document Revision Status .....	8
Definitions and Acronyms .....	9
Testing Facility .....	10
Calibrations and Accreditations.....	10
Testing Environmental Conditions and Dates .....	11
Detailed Test Results Section .....	12
Spurious Radiated Emissions.....	13
Bandwidth of Frequency Hopping Systems .....	29
Channel Carrier Separation for Frequency Hopping Systems .....	34
Number of Channels for Frequency Hopping Systems .....	42
Time of Occupancy.....	44
Maximum Peak Envelope Conducted Power .....	48
Spurious Conducted Emissions .....	54
Maximum Permissible Exposure .....	59
Power Line Conducted Emissions .....	61
Appendix A – EUT Summary.....	67
Appendix B – EUT and Test Setup Photographs.....	68

Client	Aztech Associates Inc
Product	In-Home Display 900MHz Module
Standard(s)	RSS 210 Issue 8:2010 / FCC Part 15 Subpart C 15:2010



## Report Scope

This report addresses the EMC verification testing and test results of the In-Home Display 900MHz Module from Aztech Associates Inc. This module is herein referred to as EUT (Equipment Under Test) performed at Global EMC Labs.

The EUT was tested for compliance against the following standards:

RSS 210 Issue 8:2010 / FCC Part 15 Subpart C 15:2010

Test procedures, results, justifications, and engineering considerations, if any, follow later in this report.

The results contained in this report relate only to the item(s) tested.

This report does not imply product endorsement by A2LA or any other accreditation agency, any government, or Global EMC Inc.

Opinions/interpretations expressed in this report, if any, are outside the scope of Global EMC Inc accreditation. Any opinions expressed do not necessarily reflect the opinions of Global EMC Inc, unless otherwise stated.

Client	Aztech Associates Inc
Product	In-Home Display 900MHz Module
Standard(s)	RSS 210 Issue 8:2010 / FCC Part 15 Subpart C 15:2010



## Summary

The results contained in this report relate only to the item(s) tested.

EUT FCC Certification #, FCC ID:	SCLS2010816
EUT Industry Canada Certification #, IC:	4695A-S2010816
EUT Passed all tests performed.	Yes (see test results summary)
Tests conducted by	Raymond Lee Au

Client	Aztech Associates Inc	
Product	In-Home Display 900MHz Module	
Standard(s)	RSS 210 Issue 8:2010 / FCC Part 15 Subpart C 15:2010	

## Test Results Summary

Standard/Method	Description	Class/Limit	Result
FCC 15.203	Antenna Requirement	Unique	Pass See Justification
FCC 15.205 RSS 210 Section 6.3 (Table 2)	Restricted Bands for intentional operation	Not in restricted band	Pass
FCC 15.207	Power line conducted emissions	QuasiPeak Average	Pass
FCC 15.209 RSS-210 (Table 2)	Spurious Radiated emissions	QuasiPeak Average	Pass
FCC 15.247(a)(1) RSS 210 A8.1(b)	Hopping Channel Separation	> 20dB bandwidth	Pass
FCC 15.247(a)(1)(i) RSS 210 A8.1(c)	Number of channels	$\geq 25$	Pass
FCC 15.247(a)(1)(i) RSS 210 A8.1(c)	Time of occupancy	< 0.4 seconds in 10 second period	Pass
FCC 15.247(a)(1)(i) RSS 210 A8.1(c)	Max 20dB bandwidth	< 500 kHz	Pass
FCC 15.247(b)2 RSS-210 A8.4(1)	Max output power	< 0.25 Watt	Pass
FCC 15.247(b)(4)	Antenna Gain	< 6 dBi	Pass See Justifications
FCC 15.247(d) RSS-210 A8.5	Antenna conducted spurious	>20 dBc	Pass
FCC 15.247(h)	FHSS Intelligence	No coordination	Pass See Justification
FCC 15.247(i) IC Safety code 6	Maximum Permissible Exposure	> 20 cm separation.	Pass See justification and calculations
<b>Overall Result</b>			<b>PASS</b>

Client	Aztech Associates Inc
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Standard(s)	RSS 210 Issue 8:2010 / FCC Part 15 Subpart C 15:2010



All tests were performed by Raymond Lee Au.

Testing is performed according to procedures documented in FCC Public Notice DA 00-705 - Filing and Measurement Guidelines for Frequency Hopping Spread Spectrum Systems

If the product as tested or otherwise complies with the specification, the EUT is deemed to comply with the requirement and is deemed a 'PASS' grade. If not 'FAIL' grade will be issued. Note that 'PASS' / 'FAIL' grade is independent of any measurement uncertainties. A 'PASS' / 'FAIL' grade within measurement uncertainty is marked with a '\*'.

### ***Justifications, Descriptions, or Deviations***

The following justifications for tests not performed or deviations from the above listed specifications apply:

For the Antenna requirement specified in FCC 15.203 (RSS 210 section 5.5), this device uses a wire antenna soldered onto the PCB.

For the Restricted Bands of operation, the EUT is designed to only operate between 902.8 to 914.8 MHz. (inclusive).

For the Antenna gain, this antenna has (significantly) less than 6 dBi.

For maximum permissible exposure, this device operates at less than 1 Watt at 902-928 MHz range and is designed to operate greater than 20 cm from personnel during normal operation. No testing is required, however worst case calculated exposure compliance follows later in this report.

Client	Aztech Associates Inc
Product	In-Home Display 900MHz Module
Standard(s)	RSS 210 Issue 8:2010 / FCC Part 15 Subpart C 15:2010



## ***Applicable Standards, Specifications and Methods***

ANSI C63.4:2003 - Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz

ANSI C63.10:2009 - American national standard for testing unlicensed wireless devices

CFR 47 FCC 15 - Code of Federal Regulations – Radio Frequency Devices

CISPR 22:1997 - Information technology equipment – Radio disturbance characteristics – Limits and methods of measurement

ICES-003:2012 - Information Technology Equipment (ITE) — Limits and methods of measurement

ISO 17025:2005 - General Requirements for the competence of testing and calibration laboratories

RSS 210:2010 - Issue 7: Spectrum Management and Telecommunications Policy. Radio Standards Specification Low Power Licence-Exempt Radiocommunication Devices

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Product	In-Home Display 900MHz Module
Standard(s)	RSS 210 Issue 8:2010 / FCC Part 15 Subpart C 15:2010



## ***Sample calculation(s)***

Margin = limit – (received signal + antenna factor + cable loss – pre-amp gain)

Margin = 50.5dBuV/m – (50dBuV + 10dB + 2.5dB – 20dB)

Margin = 8 dB

## ***Document Revision Status***

Revision 1 - March 25, 2013

Client	Aztech Associates Inc
Product	In-Home Display 900MHz Module
Standard(s)	RSS 210 Issue 8:2010 / FCC Part 15 Subpart C 15:2010



## Definitions and Acronyms

The following definitions and acronyms are applicable in this report.  
See also ANSI C63.14.

**AE** – Auxillary Equipment.

**BW** – Bandwidth. Unless otherwise stated, this is refers to the 6 dB bandwidth.

**EMC** – Electro-Magnetic Compatibility

**EMI** – Electro-Magnetic Immunity

**EUT** – Equipment Under Test

**ITE** – Information Technology Equipment with a primary function(s) of entry, storage, display, retrieval, transmission, processing, switching, or control, of data.

**LISN** – Line impedance stabilization network

**NCR** – No Calibration Required

**RF** – Radio Frequency

Client	Aztech Associates Inc
Product	In-Home Display 900MHz Module
Standard(s)	RSS 210 Issue 8:2010 / FCC Part 15 Subpart C 15:2010



## Testing Facility

Testing for EMC on the EUT was carried out at Global EMC labs in Toronto, Ontario, Canada. The testing lab consists of a 3m semi-anechoic chamber calibrated to be able to allow measurements on an EUT with a maximum width or length of up to 2m and height up to 3m. The chamber is equipped with a turn table that is capable of testing devices up to 3300lb in weight. This facility is capable of testing products that are rated for 120 Vac and 240Vac single phase, or 208 Vac 3 phase input. DC capability is also available. The chamber is equipped with an antenna mast that controls polarization and height from the control room adjoining the shielded chamber. Radiated emissions measurements are performed using a Bilog, and Horn antenna where applicable. Conducted emissions (where applicable), unless otherwise stated, are performed using a LISN.

## ***Calibrations and Accreditations***

The measurement site used is registered with Federal Communications Commission (FCC) and Industry Canada (IC). This site is calibrated for Normalized Site Attenuation (NSA) using test procedures outlined in ANSI C63.4 "Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz". The semi-anechoic chamber is lined with ferrite tiles and absorption cones to minimize any undesired reflections. All measuring equipment is calibrated on an annual or bi-annual basis as listed for each respective test.

Client	Aztech Associates Inc
Product	In-Home Display 900MHz Module
Standard(s)	RSS 210 Issue 8:2010 / FCC Part 15 Subpart C 15:2010



## ***Testing Environmental Conditions and Dates***

Following were the environmental conditions in the facility during time of testing –

Date	Test	Init.	Temperature (°C)	Humidity (%)	Pressure (kPa)
Jan. 10-11, 2013	Spurious Radiated Emission 9kHz – 30MHz	RA	20-25°C	30-45%	100 - 103kPa
Jan. 14-16, 2013	Spurious Radiated Emission 30MHz – 2GHz	RA	20-25°C	30-45%	100 - 103kPa
Jan. 21-22, 2013	Spurious Radiated Emission 2GHz – 10GHz	RA	20-25°C	30-45%	100 - 103kPa
Feb. 24, 2013	20dB BW	RA	20-25°C	30-45%	100 - 103kPa
Jan. 25, 2013	Max output Power	RA	20-25°C	30-45%	100 - 103kPa
Jan. 28, 2013	Hopping Channel Separation	RA	20-25°C	30-45%	100 - 103kPa
Jan. 28, 2013	Time of Occupancy	RA	20-25°C	30-45%	100 - 103kPa
Jan. 28, 2013	Number of Channels	RA	20-25°C	30-45%	100 - 103kPa
Mar. 22, 2013	Conducted Emissions	RA	20-25°C	30-45%	100 - 103kPa

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Standard(s)	RSS 210 Issue 8:2010 / FCC Part 15 Subpart C 15:2010

The logo for Global EMC Inc. features the word "GLOBAL" in blue capital letters at the top, a red globe graphic with a white star in the center, and the words "EMC INC" in large blue capital letters at the bottom.

## Detailed Test Results Section

Client	Aztech Associates Inc
Product	In-Home Display 900MHz Module
Standard(s)	RSS 210 Issue 8:2010 / FCC Part 15 Subpart C 15:2010



## ***Spurious Radiated Emissions***

### **Purpose**

The purpose of this test is to ensure that the RF energy unintentionally emitted from the EUT does not exceed the limits listed below as defined in the applicable test standard, as measured from a receiving antenna. This helps protect broadcast radio services such as television, FM radio, pagers, cellular telephones, emergency services, and so on, from unwanted interference.

### **Limit(s) and Method**

The limits, as defined in 15.247(d) for unintentional radiated emissions apply for those emissions that fall in the restricted bands, as defined in Section 15.205(a). These emissions must comply with the radiated emission limits specified in Section 15.209(a).

All unintentional emissions must also meet the 'Spurious Conducted Emissions' requirements of -20 dBc or greater. See also 'Spurious Conducted Emissions' for further details.

30 MHZ – 88 MHz, 100 uV/m (40.0 dBuV/m<sup>1</sup>) at 3 m

88 MHz – 216 MHz, 150 uV/m (43.5 dBuV/m<sup>1</sup>) at 3 m

216 MHz – 960 MHz, 200 uV/m (46.4 dBuV/m<sup>1</sup>) at 3 m

Above 960 MHz, 500 uV/m (54.0 dBuV/m<sup>1</sup>) at 3 m

Above 1000 MHz, 500 uV/m (54.0 dBuV/m<sup>2</sup>) at 3m

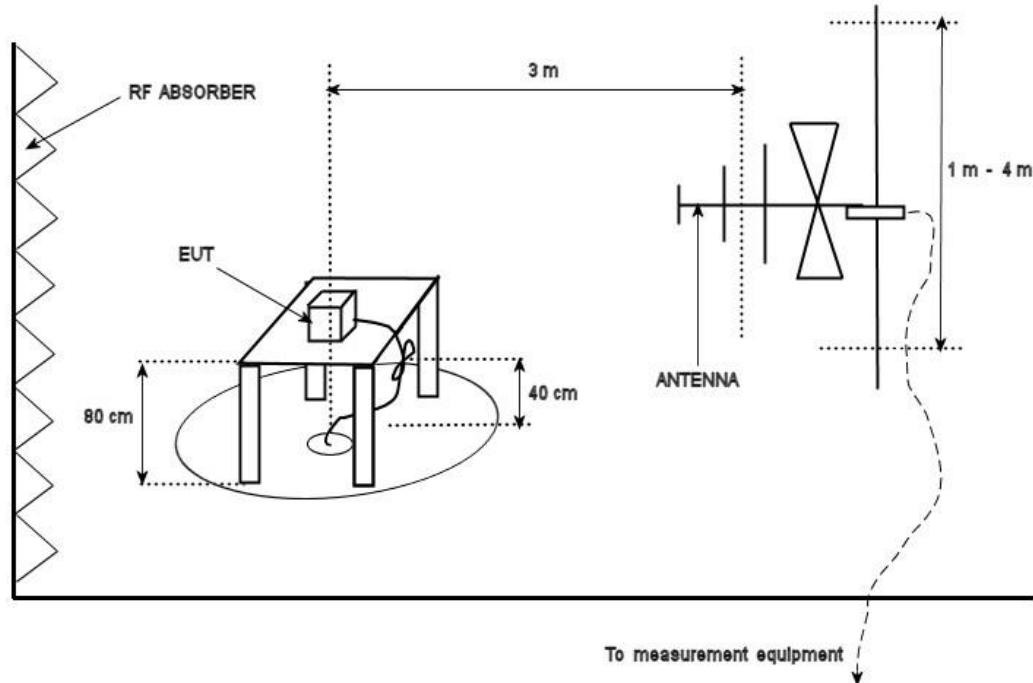
<sup>1</sup>Limit is with 120 kHz measurement bandwidth and a using a Quasi Peak detector.

<sup>2</sup>Limit is with 1 MHz measurement bandwidth and using an Average detector, scanned in accordance with 15.33 to above the 10<sup>th</sup> harmonic.

Client	Aztech Associates Inc
Product	In-Home Display 900MHz Module
Standard(s)	RSS 210 Issue 8:2010 / FCC Part 15 Subpart C 15:2010



## Typical Radiated Emissions Setup



Client	Aztech Associates Inc
Product	In-Home Display 900MHz Module
Standard(s)	RSS 210 Issue 8:2010 / FCC Part 15 Subpart C 15:2010



## Measurement Uncertainty

The expanded measurement uncertainty is calculated in accordance with CISPR 16-4-2 and is +/-4.4 dB with a 'k=2' coverage factor and a 95% confidence level.

## Preliminary Graphs

Note the graphs shown below are for graphical illustration only. For final measurements with the appropriate detector, please refer to the final measurement table where applicable. The graphs shown below are maximized peak measurement graphs, measured with a resolution bandwidth greater than the final required detector and over a full 0-360° rotation. This peaking process is done as a worst case measurement. This process enables the detection of frequencies of concern for final measurement, and provides considerable time savings.

In accordance with FCC Part 15, Subpart A, Section 15.33, the device was scanned to the 10<sup>th</sup> harmonic (a minimum of a 10 GHz).

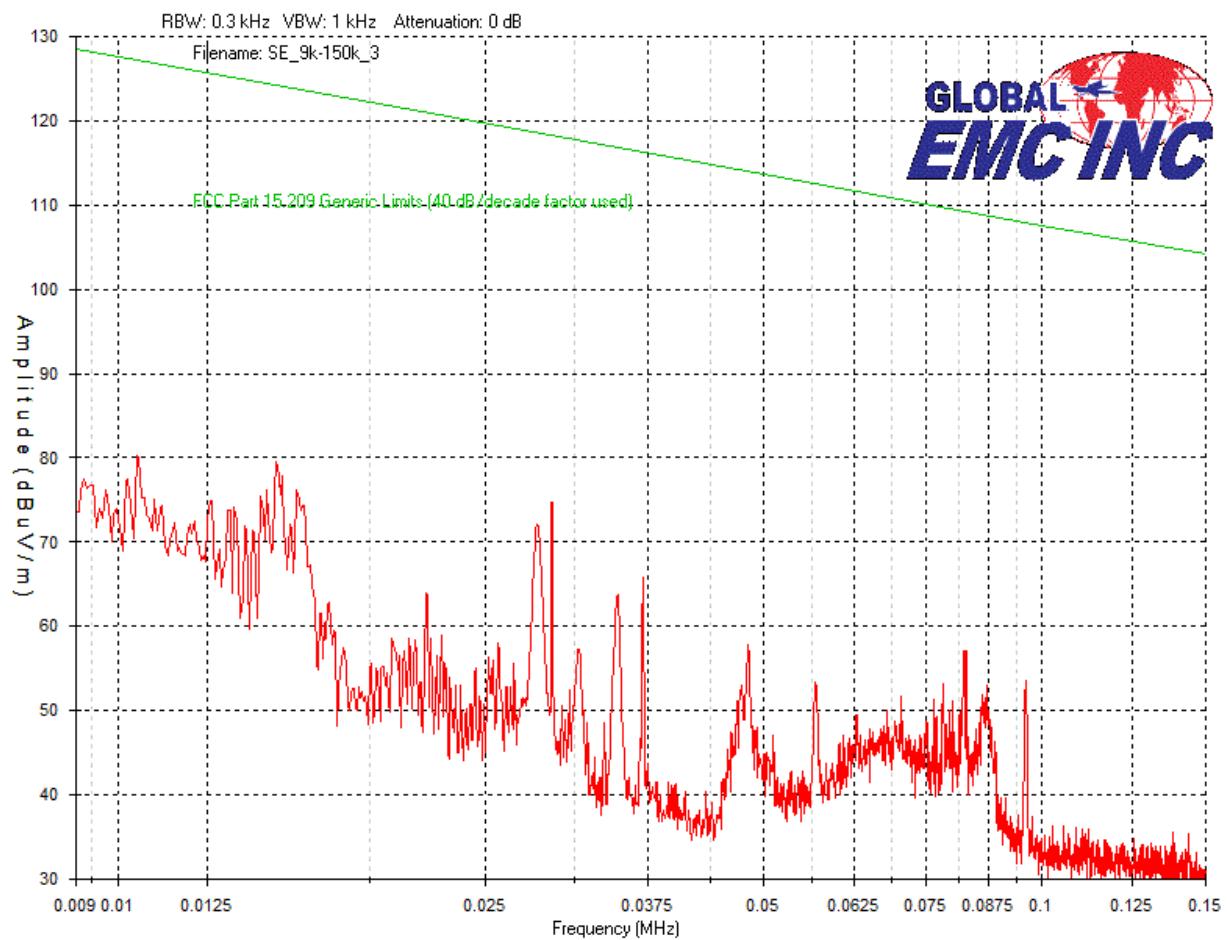
The EUT was tested in three orthogonal planes to find the worst case measurement results. Low, middle, and high channels were scanned. The graphs shown below are that of the worst case scenario, which occurs with the EUT in the upright position (PCB component sides vertical).

Receiver mode was detected to be identical, with the exception of the fundamental and related harmonics.

Client	Aztech Associates Inc
Product	In-Home Display 900MHz Module
Standard(s)	RSS 210 Issue 8:2010 / FCC Part 15 Subpart C 15:2010



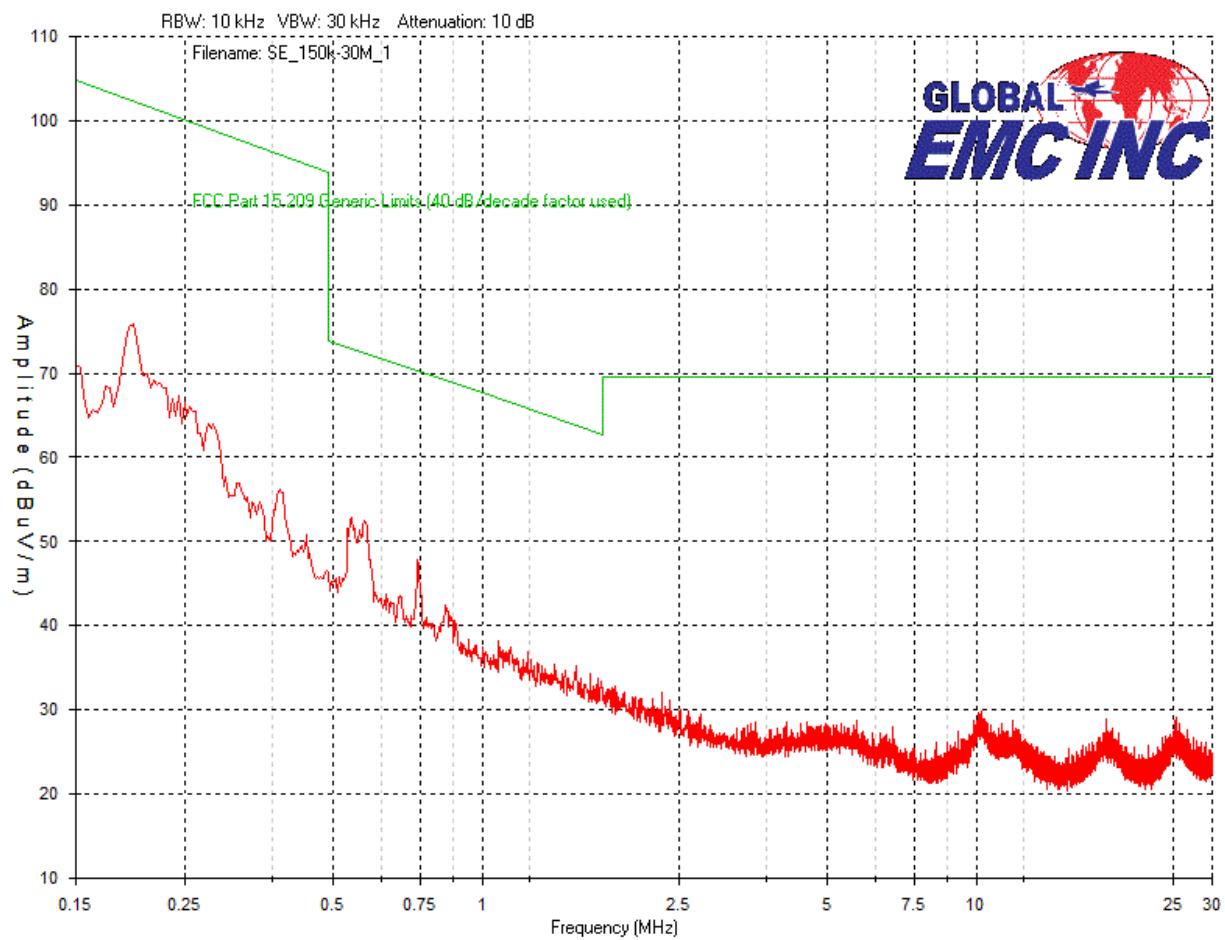
Peak Emissions Graph  
9kHz to 150kHz



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Standard(s)	RSS 210 Issue 8:2010 / FCC Part 15 Subpart C 15:2010



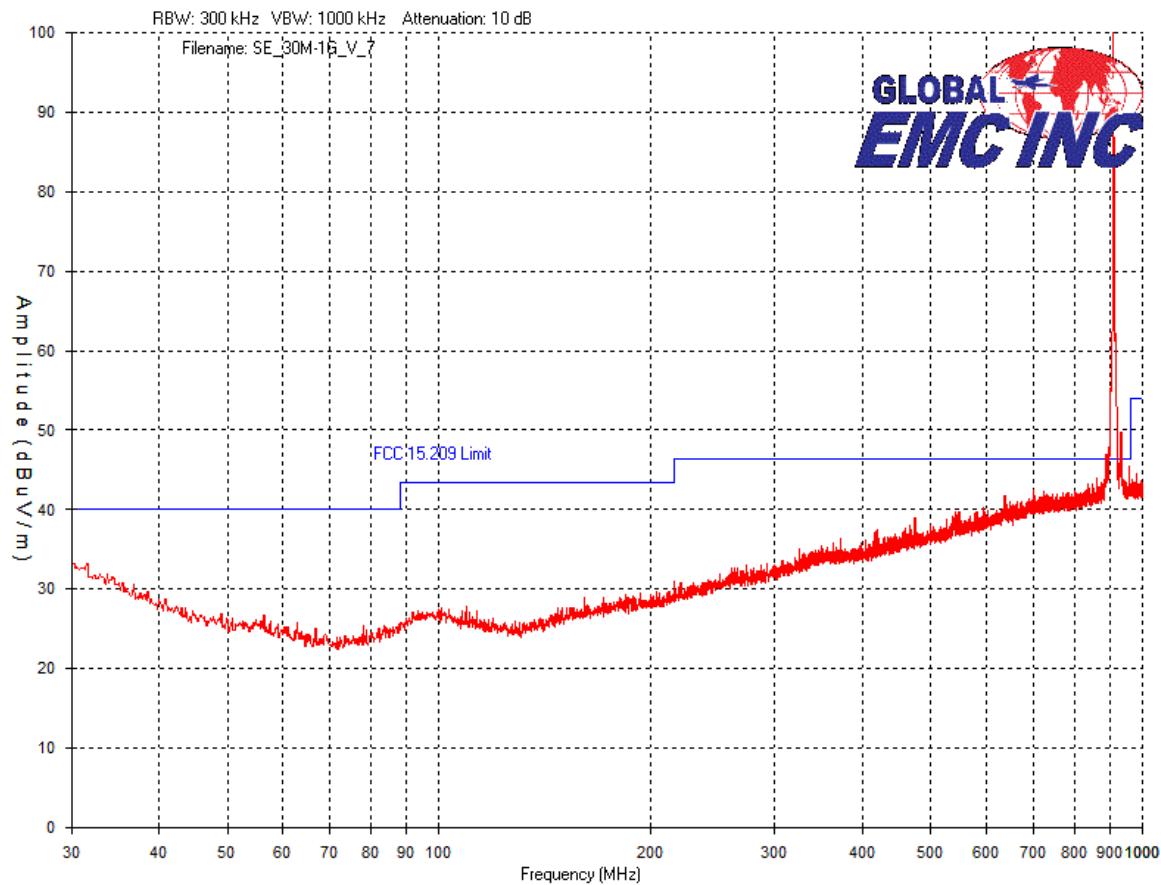
Peak Emissions Graph  
150kHz to 30MHz



Client	Aztech Associates Inc
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Standard(s)	RSS 210 Issue 8:2010 / FCC Part 15 Subpart C 15:2010



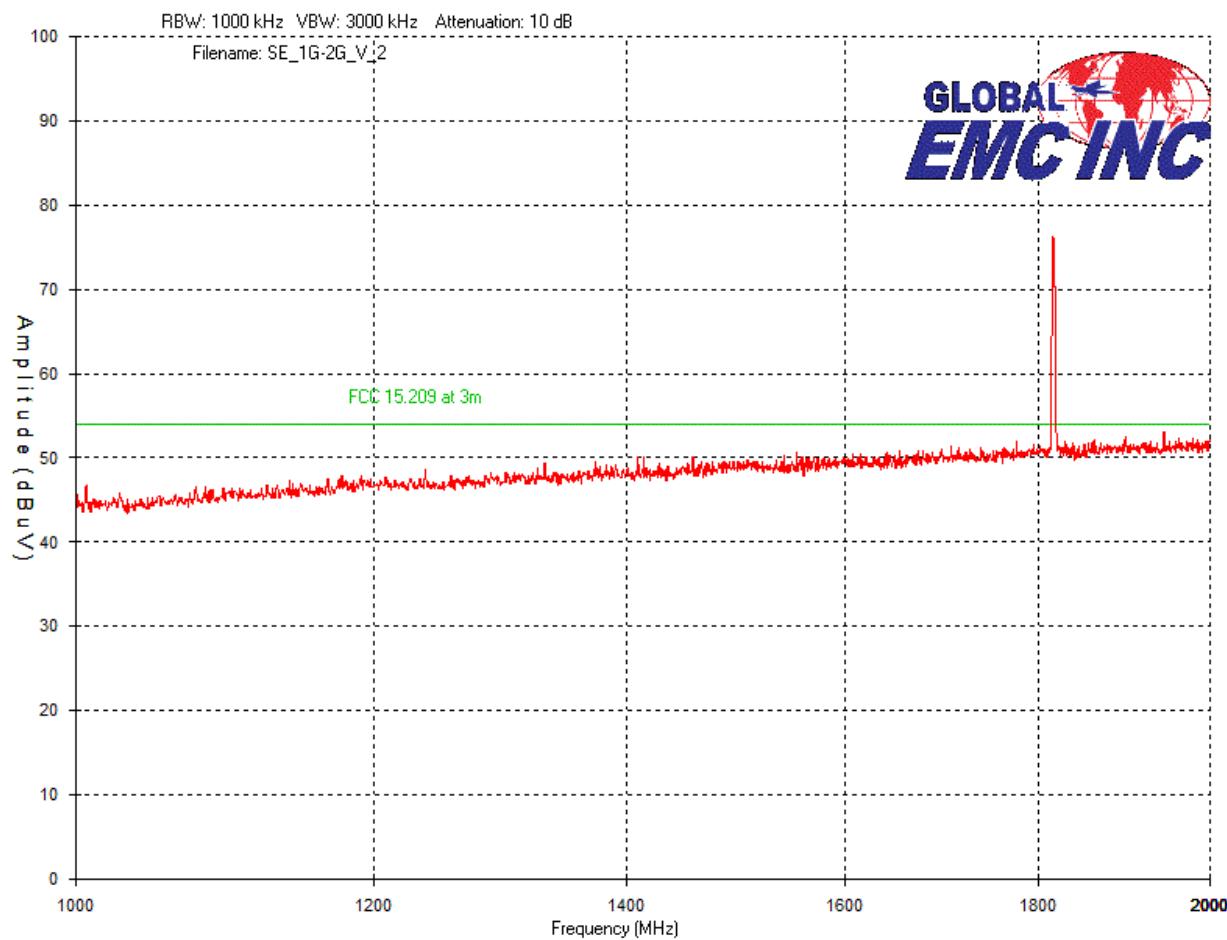
Vertical Peak Emissions Graph  
30MHz to 1GHz



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Standard(s)	RSS 210 Issue 8:2010 / FCC Part 15 Subpart C 15:2010



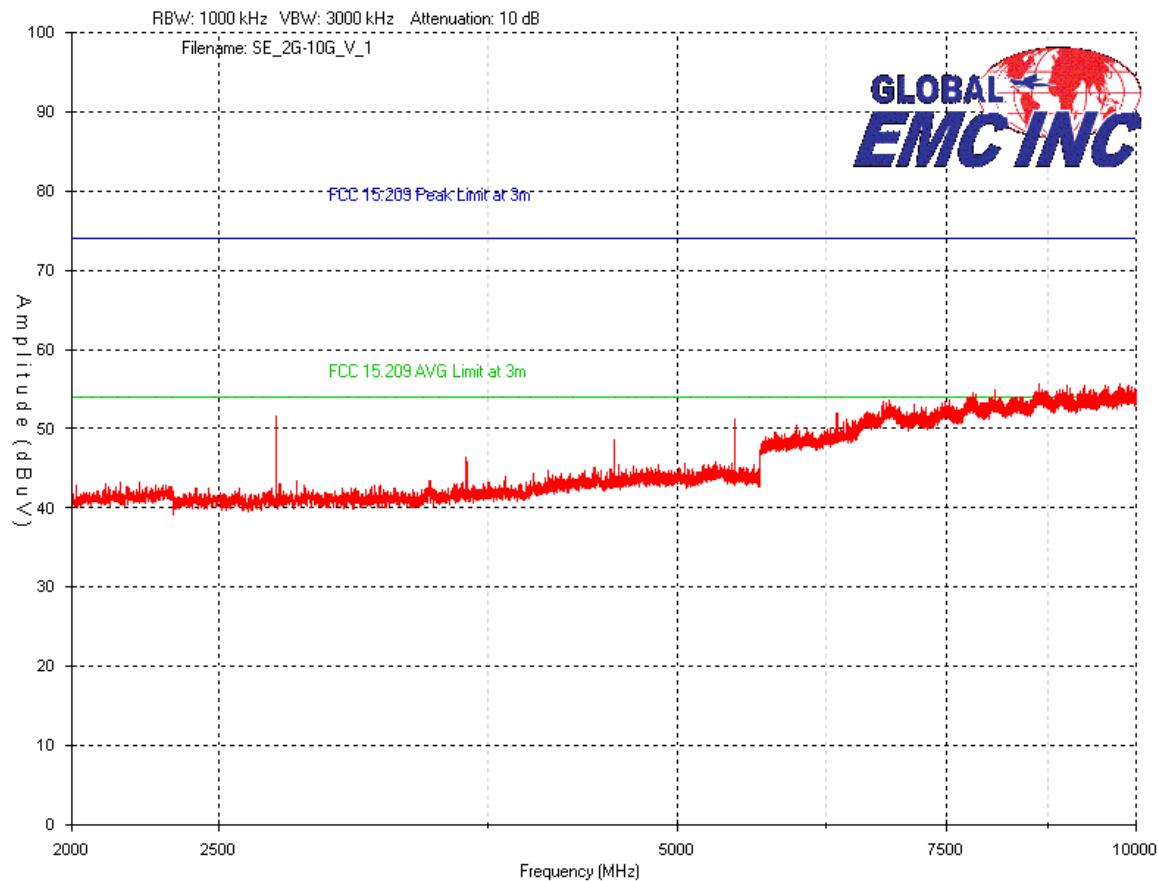
Vertical – Peak Emissions Graph  
1GHz to 2 GHz



Client	Aztech Associates Inc
Product	In-Home Display 900MHz Module
Standard(s)	RSS 210 Issue 8:2010 / FCC Part 15 Subpart C 15:2010

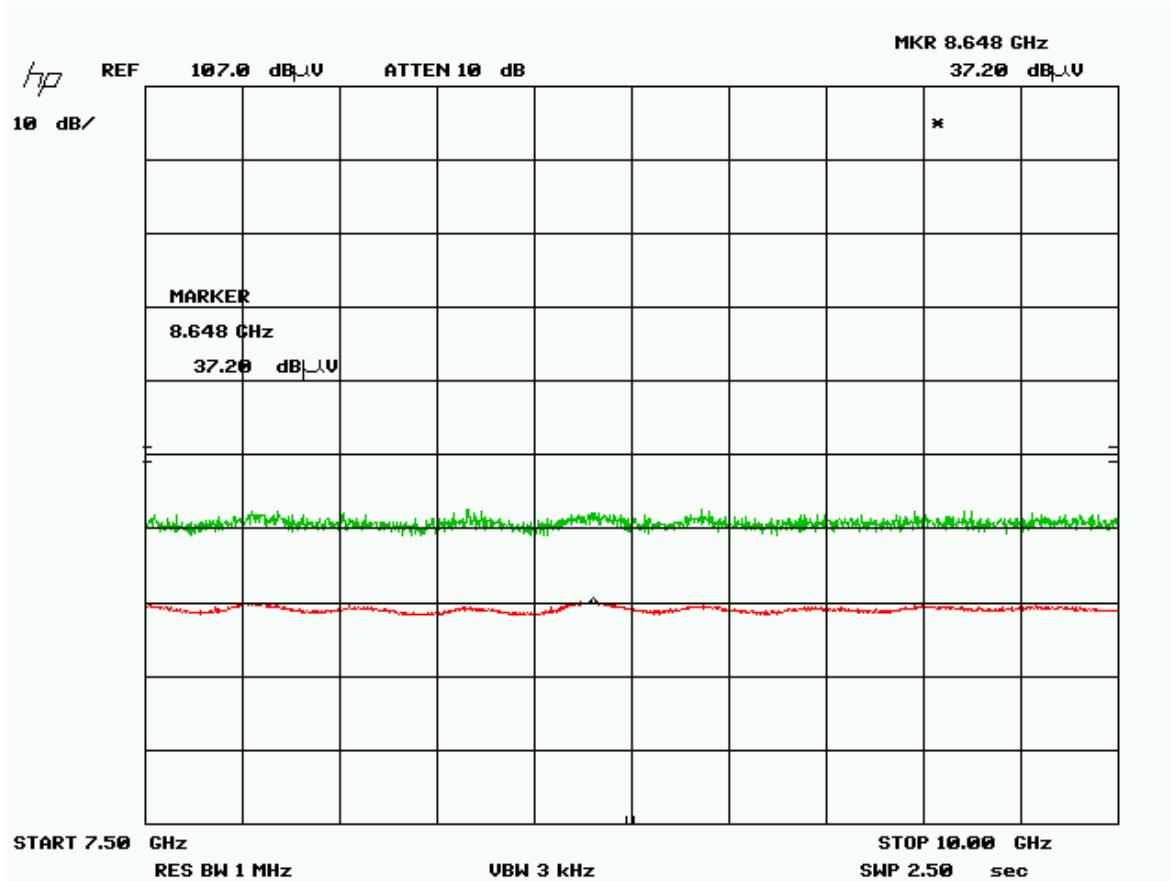


Vertical – Peak Emissions Graph  
2 GHz to 10 GHz



Client	Aztech Associates Inc	
Product	In-Home Display 900MHz Module	
Standard(s)	RSS 210 Issue 8:2010 / FCC Part 15 Subpart C 15:2010	

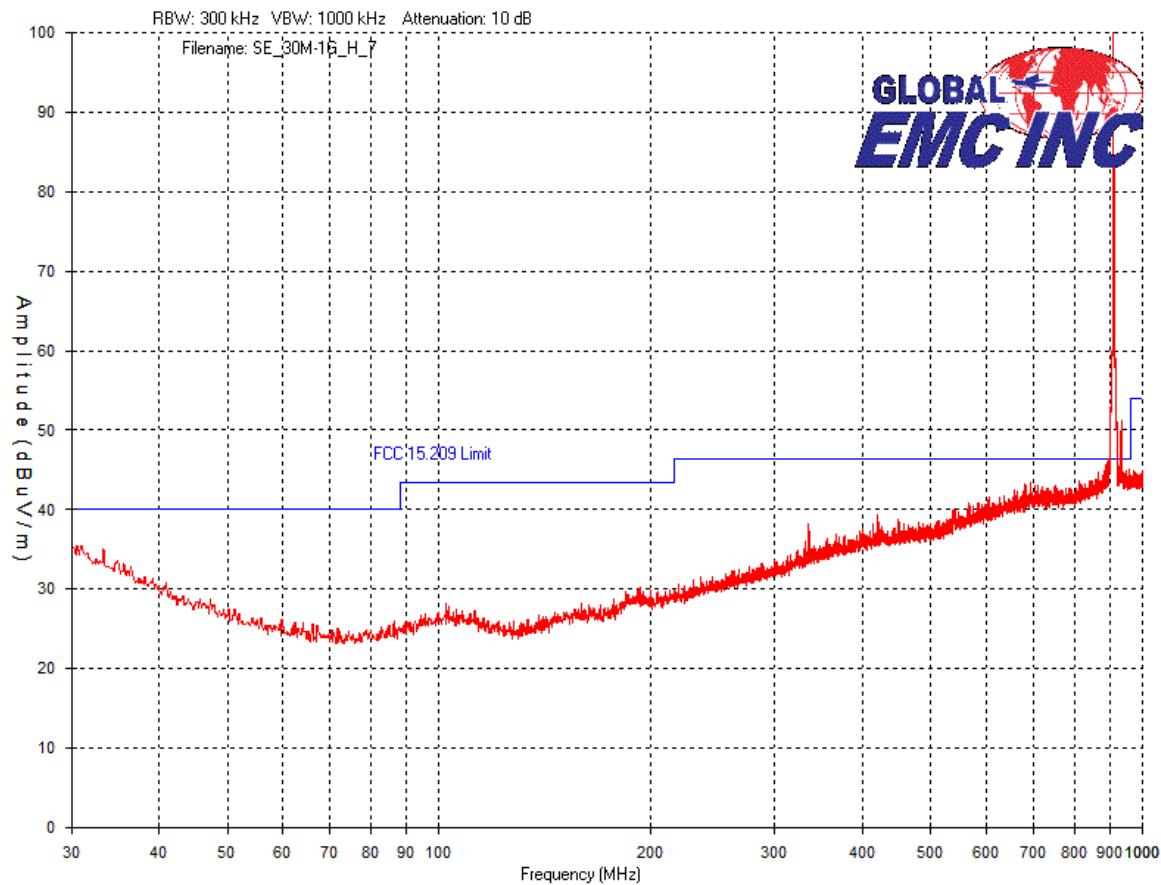
Vertical – Peak Emissions Graph  
 Peak vs. Average plot (un-factored readings)  
 7.5 GHz to 10 GHz



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Product	In-Home Display 900MHz Module
Standard(s)	RSS 210 Issue 8:2010 / FCC Part 15 Subpart C 15:2010

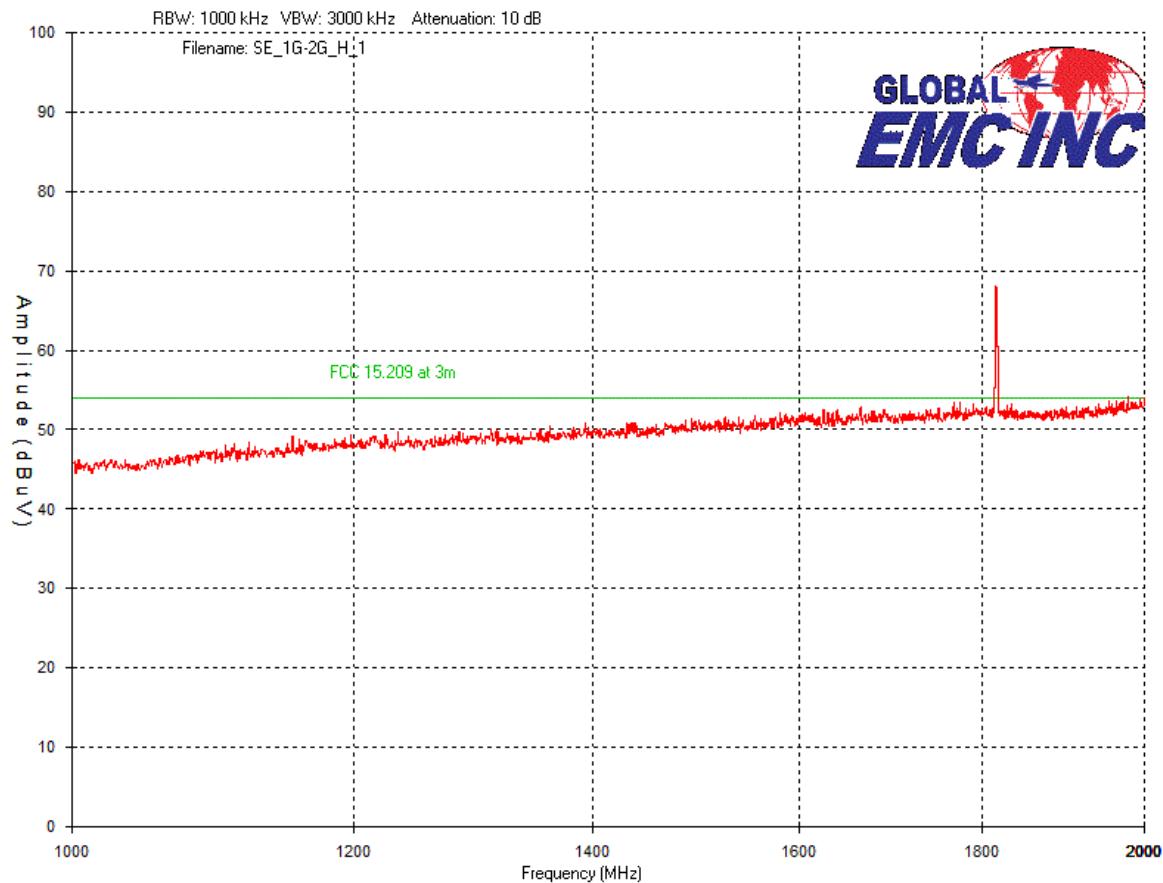


Horizontal – Peak Emissions Graph  
30MHz to 1GHz



Client	Aztech Associates Inc	
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Standard(s)	RSS 210 Issue 8:2010 / FCC Part 15 Subpart C 15:2010	

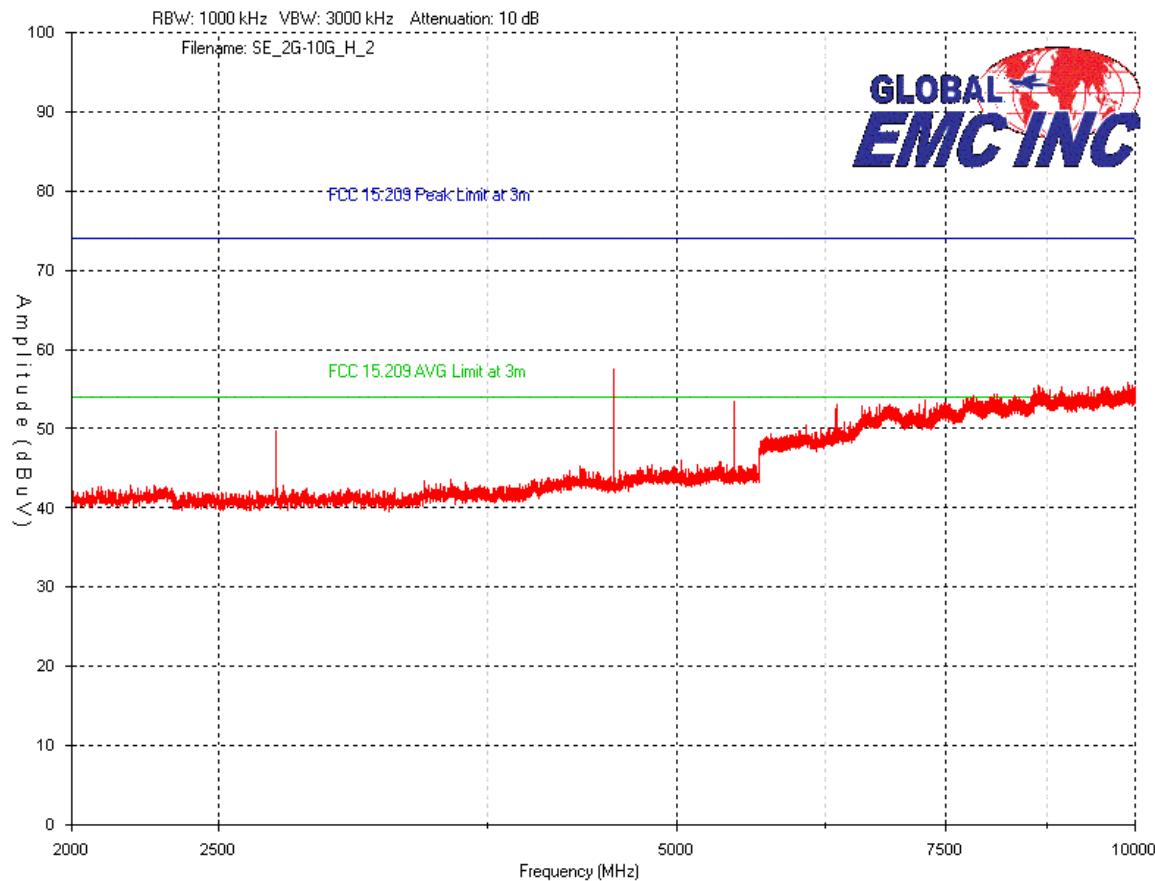
Horizontal – Peak Emissions Graph  
1GHz to 2 GHz



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Product	In-Home Display 900MHz Module
Standard(s)	RSS 210 Issue 8:2010 / FCC Part 15 Subpart C 15:2010



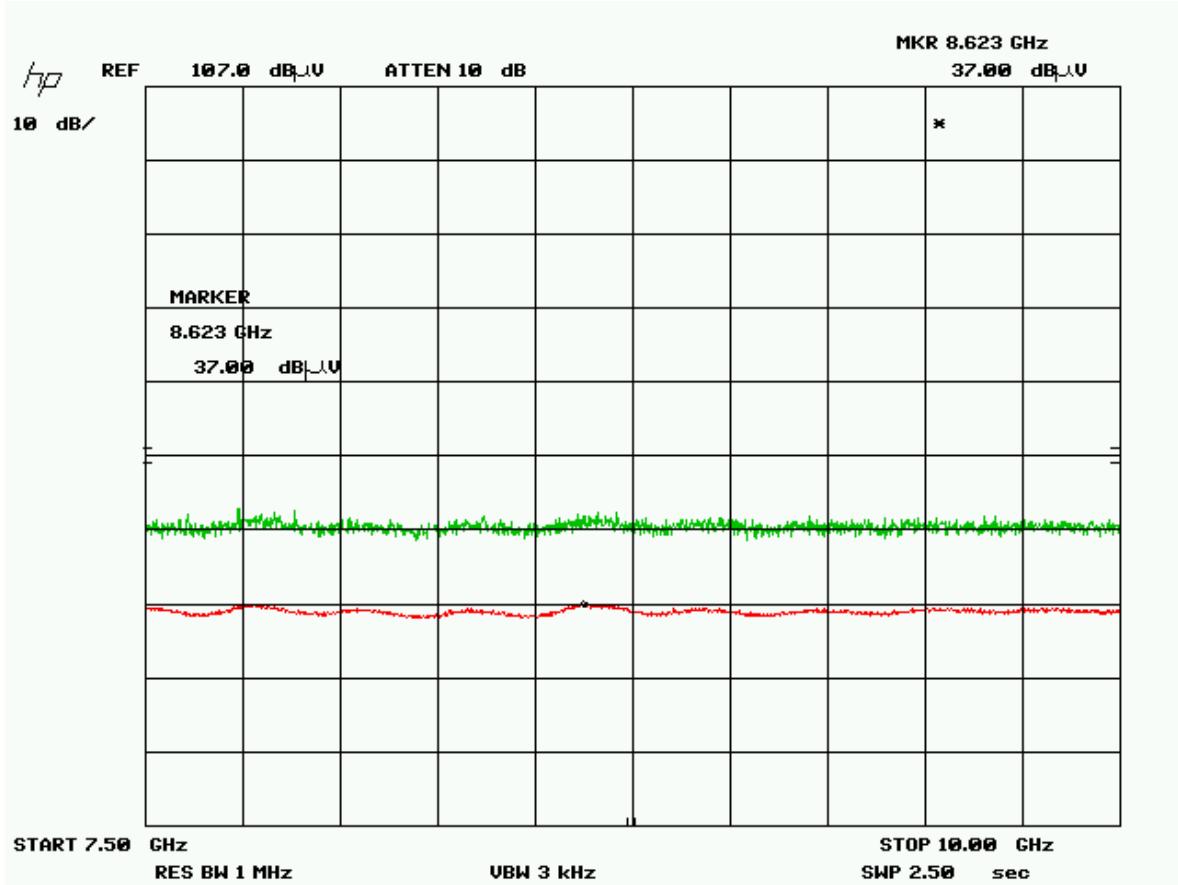
Horizontal – Peak Emissions Graph  
2 GHz to 10 GHz



Client	Aztech Associates Inc
Product	In-Home Display 900MHz Module
Standard(s)	RSS 210 Issue 8:2010 / FCC Part 15 Subpart C 15:2010

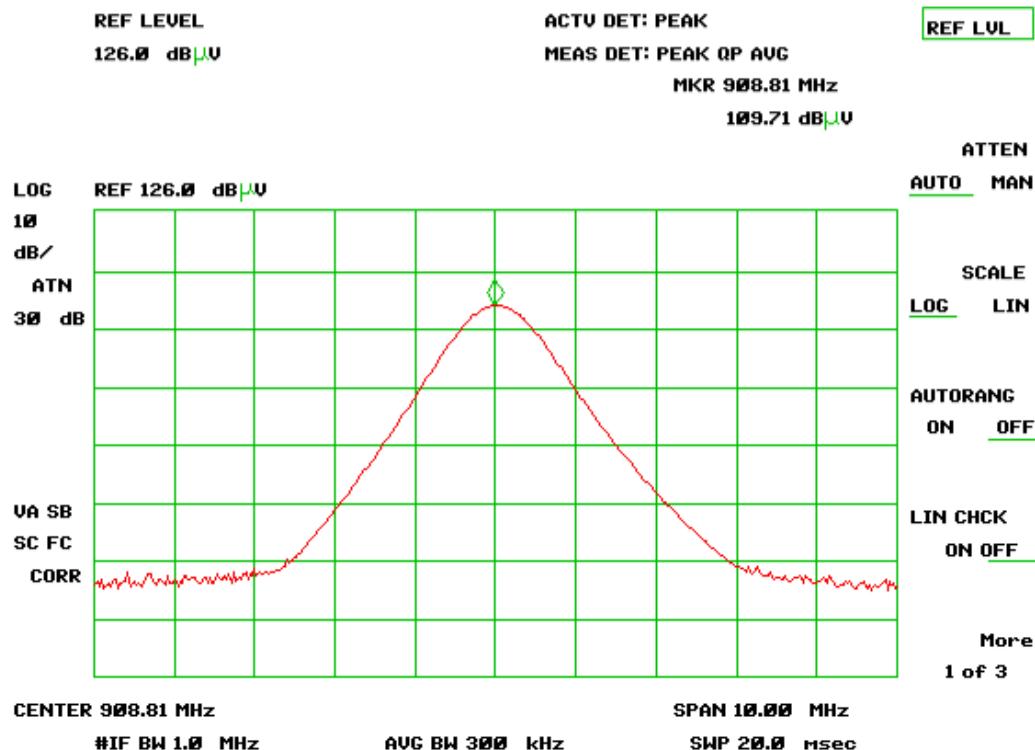


Horizontal – Peak Emissions Graph  
 Peak vs. Average plot (un-factored readings)  
 7.5 GHz to 10 GHz



Client	Aztech Associates Inc	
Product	In-Home Display 900MHz Module	
Standard(s)	RSS 210 Issue 8:2010 / FCC Part 15 Subpart C 15:2010	

Max Fundamental Peak Emissions Graph  
 (Un-factored Readings)  
 Vertical Antenna Polarity



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Product	In-Home Display 900MHz Module
Standard(s)	RSS 210 Issue 8:2010 / FCC Part 15 Subpart C 15:2010



## Final Measurements

For information purposes, the worst case fundamental was measured to be 106.3dBuV/m at 3 meters.

Emission above 15.209 limits seen between 1.8GHz – 2GHz occurs at the second harmonic of the intentional transmission frequency, and does not fall within a restricted band

Emission shown above 15.209 limits between 2.5GHz – 5GHz in the plot scanned at horizontal antenna polarity passes average limits. See table below for values.

Average values between 7.5GHz -10GHz are verified to be below average limits.

The maximum average measurement between 7.5GHz -10GHz is shown below. All average readings within this range are under limits.

All peak emissions meet limits where peak limits are defined.

Emissions Table

Frequency (MHz)	Detector	Raw Reading (dBuV)	Antenna Factor (dB/m)	Cable Factor (dB)	Preamp (dB)	Level (dBuV/m)	Limit (dB)	Margin (dB)	Result
Vertical Antenna Polarity									
908.8	Peak	109.7	30.6	2.2	36.2	106.3	---	---	Pass. Max Fund.
8648	Avg	37.2	39.3	2.6	-36.2	42.9	54	11.1	Pass. Max 7.5GHz – 10GHz
Horizontal Antenna Polarity									
4543.3	Avg	53.7	33.3	1.9	-35.7	53.2	54	0.8	Pass
8623	Avg	37.0	39.3	2.6	-36.2	42.7	54	11.3	Pass. Max 7.5GHz – 10GHz

Client	Aztech Associates Inc	
Product	In-Home Display 900MHz Module	
Standard(s)	RSS 210 Issue 8:2010 / FCC Part 15 Subpart C 15:2010	

## Test Equipment List

Equipment	Model No.	Manufacturer	Last calibration date	Next calibration due date	Asset #
Spectrum Analyzer	8566B	HP	Dec 21, 2011	Dec 21, 2013	GEMC 141
Quasi-Peak Adapter	85650A	HP	Dec 21, 2011	Dec 21 2013	GEMC 7
BiLog Antenna	3142-C	ETS	Aug 28, 2012	Aug 28, 2014	GEMC 8
Loop Antenna 30Hz – 1MHz	EM 6871	Electro-Metrics	Feb 5, 2013	Feb 5, 2015	GEMC 70
Loop Antenna 100kHz – 30MHz	EM 6872	Electro-Metrics	Feb 5, 2013	Feb 5, 2015	GEMC 71
Q-Par Horn 1.5GHz -18 GHz	6878/24	Q-par	Aug 23, 2012	Aug 23, 2014	GEMC 6365
Chase Preamp 9kHz - 2 GHz	CPA9231A	Chase	Aug 29, 2012	Aug 29, 2014	GEMC 6403
Pre-amp 1-26GHz	HP 8449B	HP	Aug 22, 2012	Aug 22, 2014	GEMC 6351
RF Cable 7m	LMR-400-7M-50OHM-MN-MN	LexTec	NCR	NCR	GEMC 28
RF Cable 1m	LMR-400-1M-50OHM-MN-MN	LexTec	NCR	NCR	GEMC 29
RF Cable 0.5M	LMR-400-0.5M-50OHM-MN-MN	LexTec	NCR	NCR	GEMC 31

This report module is based on GEMC template "FCC - 15.209 - Radiated Emissions\_Rev1.doc"

Client	Aztech Associates Inc	
Product	In-Home Display 900MHz Module	
Standard(s)	RSS 210 Issue 8:2010 / FCC Part 15 Subpart C 15:2010	

## ***Bandwidth of Frequency Hopping Systems***

### **Purpose**

The purpose of this test is to obtain the 20dB bandwidth, which is used to establish other limits. Although there is no specific limit for this requirement, the derived limits dependant on this information helps allow for other spread spectrum devices to co-exist in the same frequency spectrum. This also helps prevent corruption of data by ensuring adequate channel separation to distinguish the reception of the intended information.

### **Limits**

There is no specified limit. However, an approximate calculated maximum limit can be obtained by dividing the maximum bandwidth of the frequency allocation by the minimum number of channels. Note that this is a maximum bandwidth, and the measurement is used to calculate other limits.

902 to 928 MHz <sup>1</sup>	902 to 928 MHz <sup>2</sup>	2.4 to 2.4835 GHz	5.725 GHz to 5.85 GHz
26 MHz / 50	26 MHz / 25	83.5 MHz / 15	125 MHz / 75
520 kHz	1.04 MHz	5.57 MHz	1.67 MHz

Note 1: When the 20 dB BW is less than 250 kHz

Note 2: When the 20 dB BW is greater than 250 kHz

### **Results**

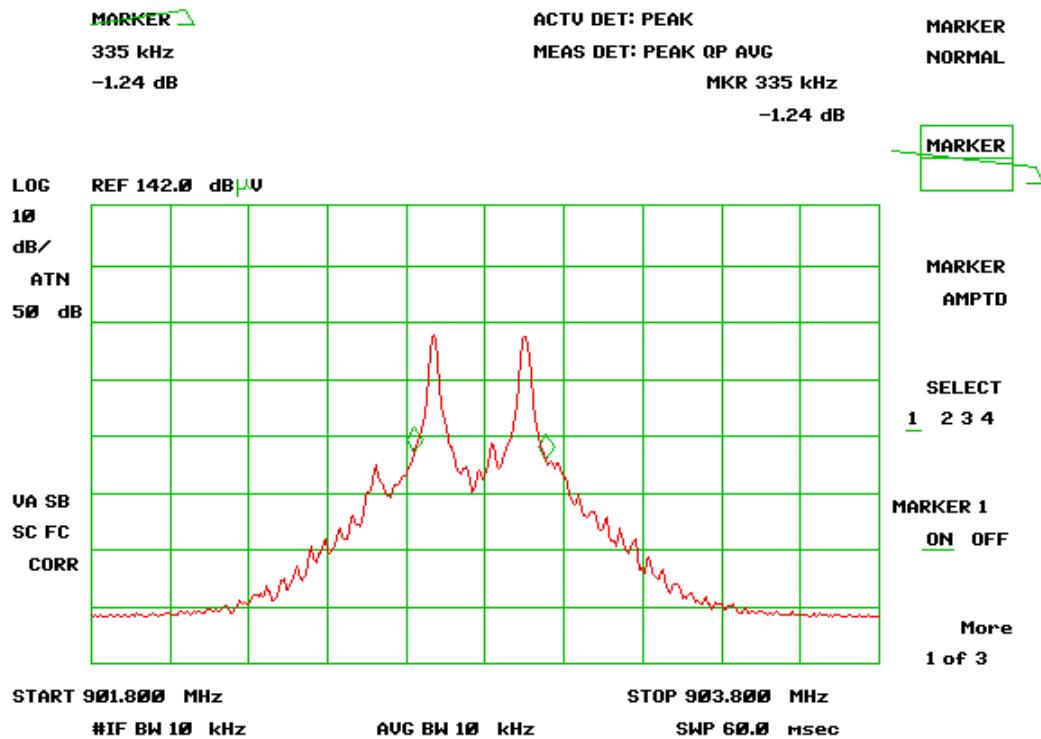
The 20 dB BW measured was 337kHz.

Client	Aztech Associates Inc	
Product	In-Home Display 900MHz Module	
Standard(s)	RSS 210 Issue 8:2010 / FCC Part 15 Subpart C 15:2010	

## Graph(s)

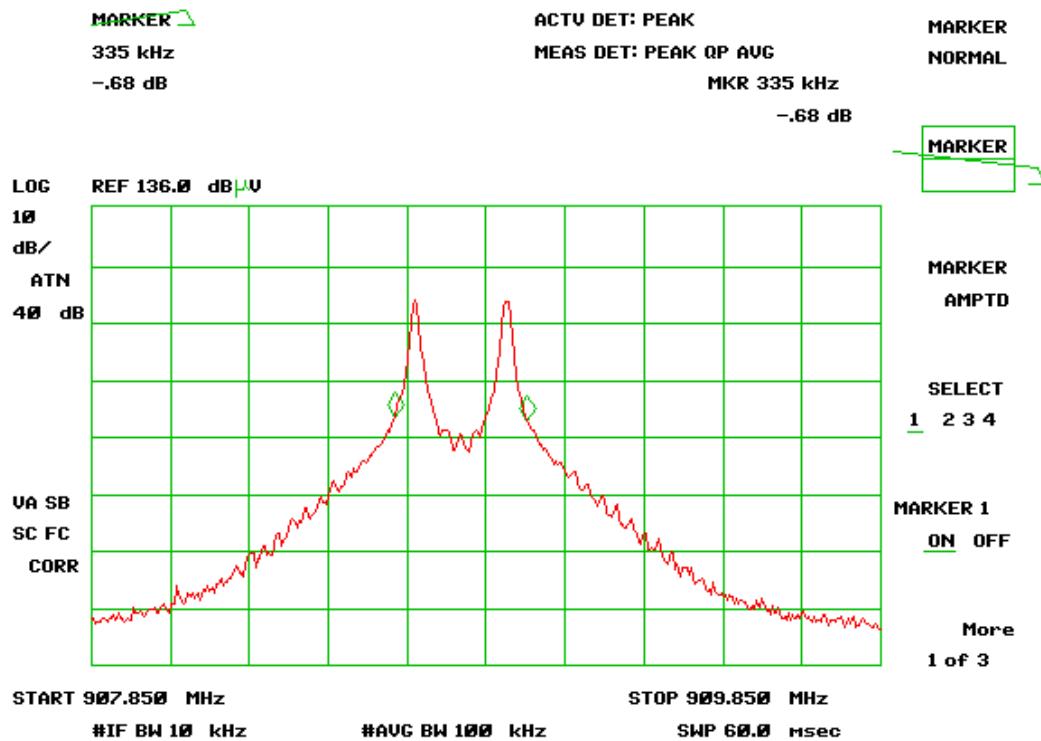
The graph shown below shows the channel spacing during the operation of the device. This is measured by a max hold on the spectrum analyzer and the highest resolution bandwidth that is sufficiently low to exhibit the 20 dB bandwidth of a channel during operation of the EUT. This measurement is a peak measurement. Max hold is performed for a duration of not less than 1 minute. Low, middle, and channels are tested. The maximum value is 337kHz occurring during transmission on high channel.

### Low Channel



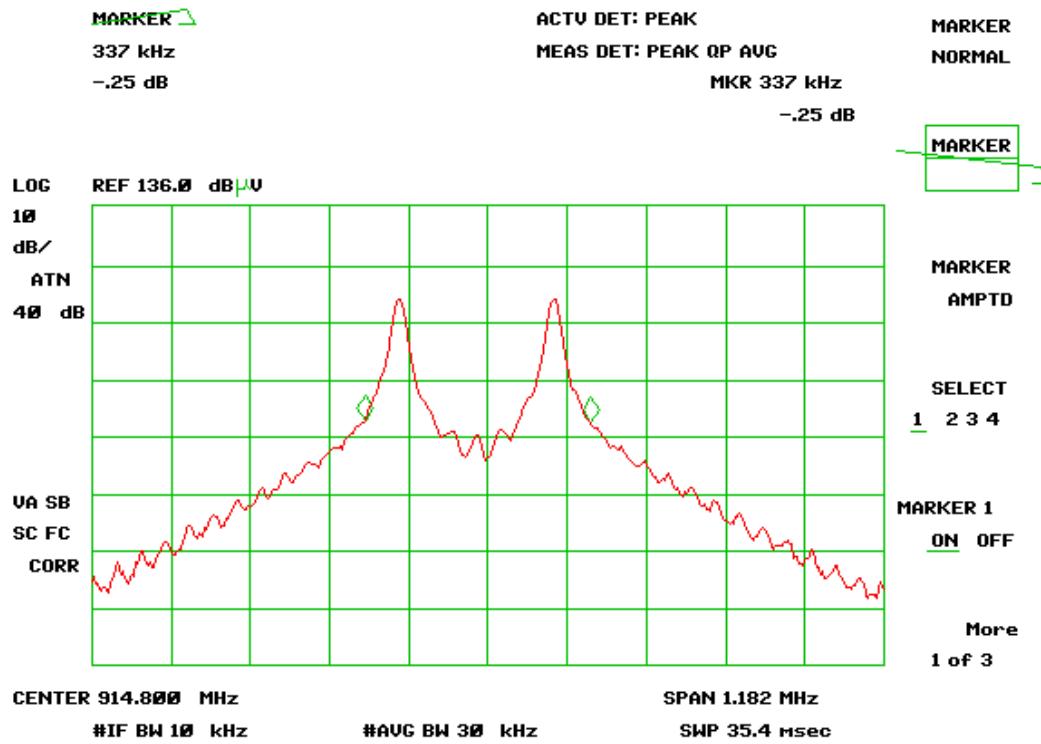
Client	Aztech Associates Inc	
Product	In-Home Display 900MHz Module	
Standard(s)	RSS 210 Issue 8:2010 / FCC Part 15 Subpart C 15:2010	

## Middle Channel



Client	Aztech Associates Inc	
Product	In-Home Display 900MHz Module	
Standard(s)	RSS 210 Issue 8:2010 / FCC Part 15 Subpart C 15:2010	

## High Channel



Note: See 'Appendix B – EUT & Test Setup Photographs' for photos showing the test set-up.

Client	Aztech Associates Inc	
Product	In-Home Display 900MHz Module	
Standard(s)	RSS 210 Issue 8:2010 / FCC Part 15 Subpart C 15:2010	

## Test Equipment List

Equipment	Model No.	Manufacturer	Last calibration date	Next calibration due date	Asset #
Spectrum Analyzer	8566B	HP	Dec 21, 2011	Dec 21, 2013	GEMC 141
Attenuator 10 dB	FP-50-10	Trilithic	NCR	NCR	GEMC 42
RF Cable 1m	LMR-400-1M-50OHM-MN-MN	LexTec	NCR	NCR	GEMC 29

This report module is based on GEMC template "FCC – Power Line Conducted Emissions Class B\_Rev1"

Client	Aztech Associates Inc
Product	In-Home Display 900MHz Module
Standard(s)	RSS 210 Issue 8:2010 / FCC Part 15 Subpart C 15:2010



## ***Channel Carrier Separation for Frequency Hopping Systems***

### **Purpose**

The purpose of this test is to ensure that the RF energy of frequency hopping systems is sufficiently spread over a spectrum and that the radio energy is not overly dense. This limit helps allow for other spread spectrum devices to co-exist in the same frequency spectrum. This also helps prevent corruption of data by ensuring adequate channel separation to distinguish the reception of the intended information.

### **Limits**

The limits are as defined in 47 CFR FCC Part 15 Section 15.247(a)(1)

No conditions	902 to 928 MHz 25 kHz or 20 dB BW <sup>1</sup>	2.4 to 2.4835 GHz 25 kHz or 20 dB BW <sup>1</sup>	5.275 to 5.85 GHz 25 kHz or 20 dB BW <sup>1</sup>
< 125 mW	25 kHz or 20 dB BW <sup>1</sup>	25 kHz or 2/3 of 20 dB BW <sup>1</sup>	25 kHz or 20 dB BW <sup>1</sup>

Note 1: Whichever is greater. The 20 dB BW of the system was measured to be 337 kHz, therefore a limit of 337 kHz applies.

### **Results**

The EUT passed the requirements of channel carrier spacing. The EUT transmits on channels 1, 3, 4, 5, 6, 7, 8, 11, 12, 13, 14, 15, 16, 18, 19, 20, 21, 22, 23, 25, 26, 27, 28, 29, and 31. All spacing exceeded the measured 20dB bandwidth of the EUT. The 20 dB BW previously measured was 337 kHz, and the device has channel spacing  $\geq$  395 kHz ( $\pm 30$  kHz).

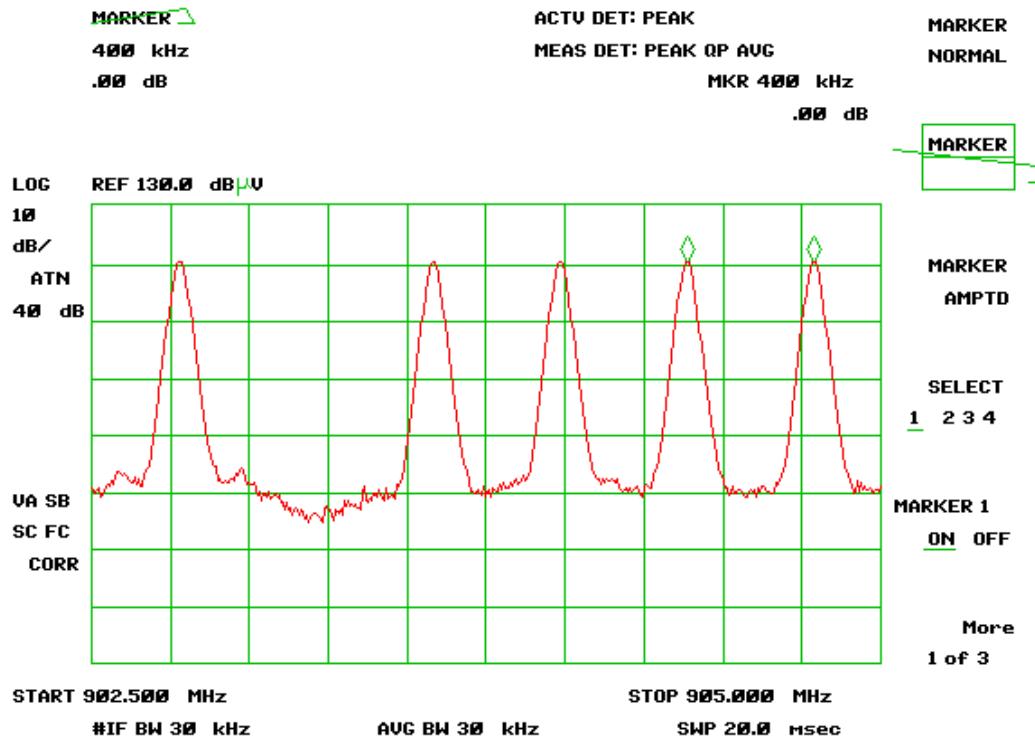
Client	Aztech Associates Inc
Product	In-Home Display 900MHz Module
Standard(s)	RSS 210 Issue 8:2010 / FCC Part 15 Subpart C 15:2010



## Graph(s)

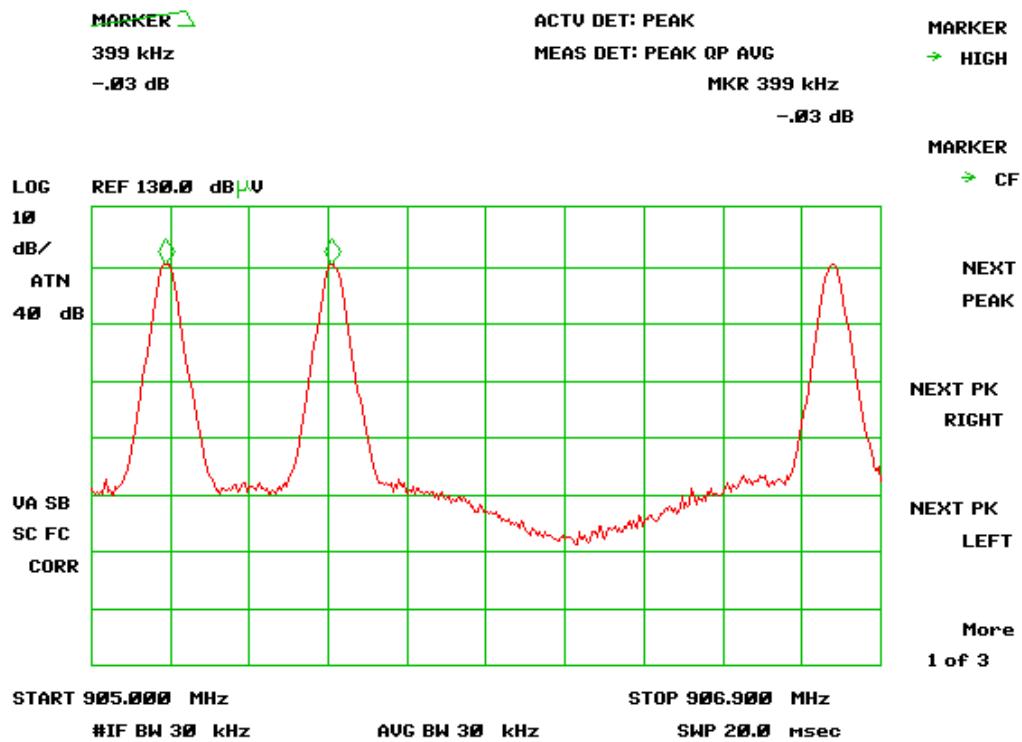
The graphs below show the minimum channel spacing between carrier frequencies. This is measured by a max hold on the spectrum analyzer and the highest resolution bandwidth that is sufficiently low to exhibit the channel spacing of the signal being measured. This measurement is a peak measurement. Max hold is performed for a duration of not less than 1 minute, as the device is stepped through adjacent channels.

Minimum channel separation between Channels 1, 3, 4, 5, 6



Client	Aztech Associates Inc	
Product	In-Home Display 900MHz Module	
Standard(s)	RSS 210 Issue 8:2010 / FCC Part 15 Subpart C 15:2010	

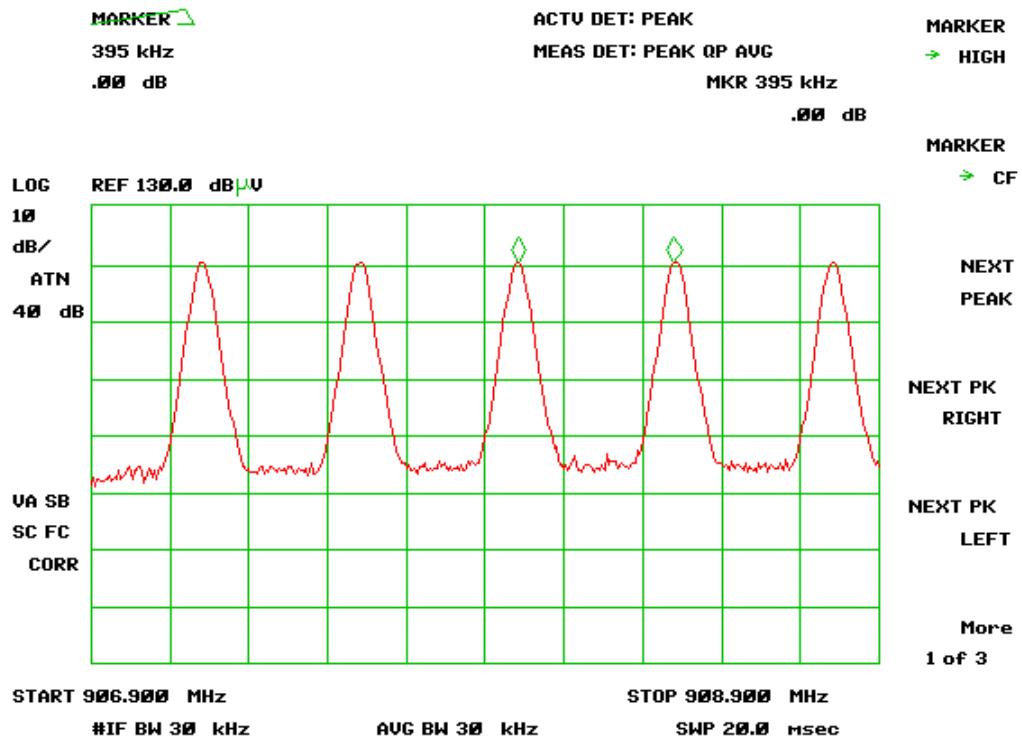
Minimum channel separation between Channels 7, 8, 11



Client	Aztech Associates Inc
Product	In-Home Display 900MHz Module
Standard(s)	RSS 210 Issue 8:2010 / FCC Part 15 Subpart C 15:2010

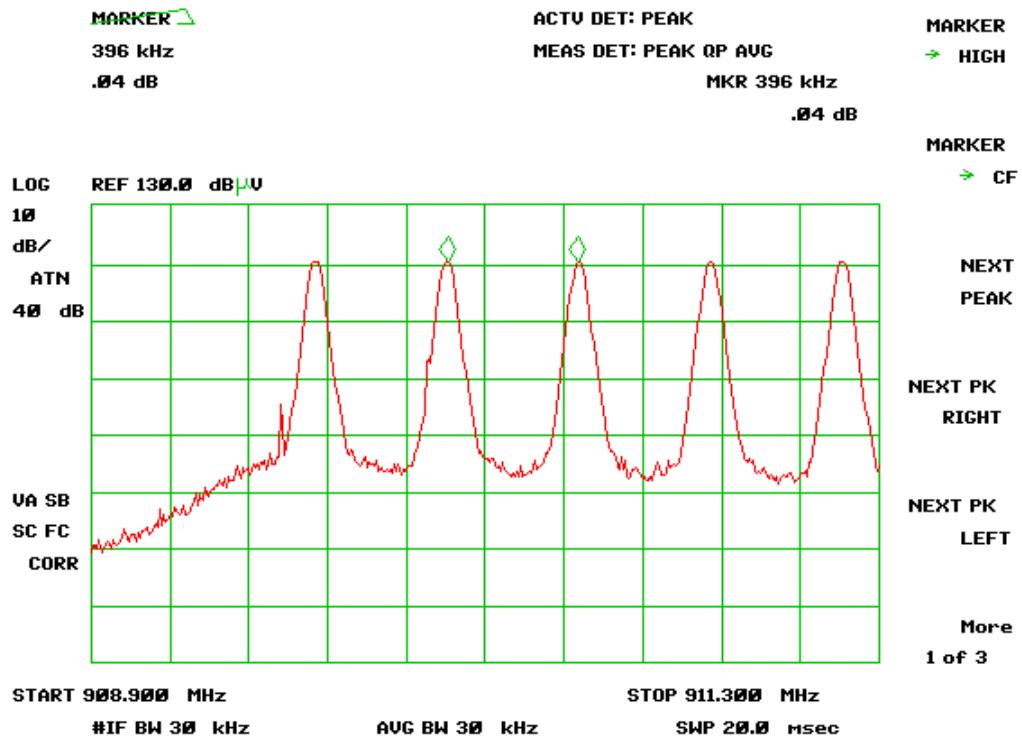


Minimum channel separation between Channels 12, 13, 14, 15, 16



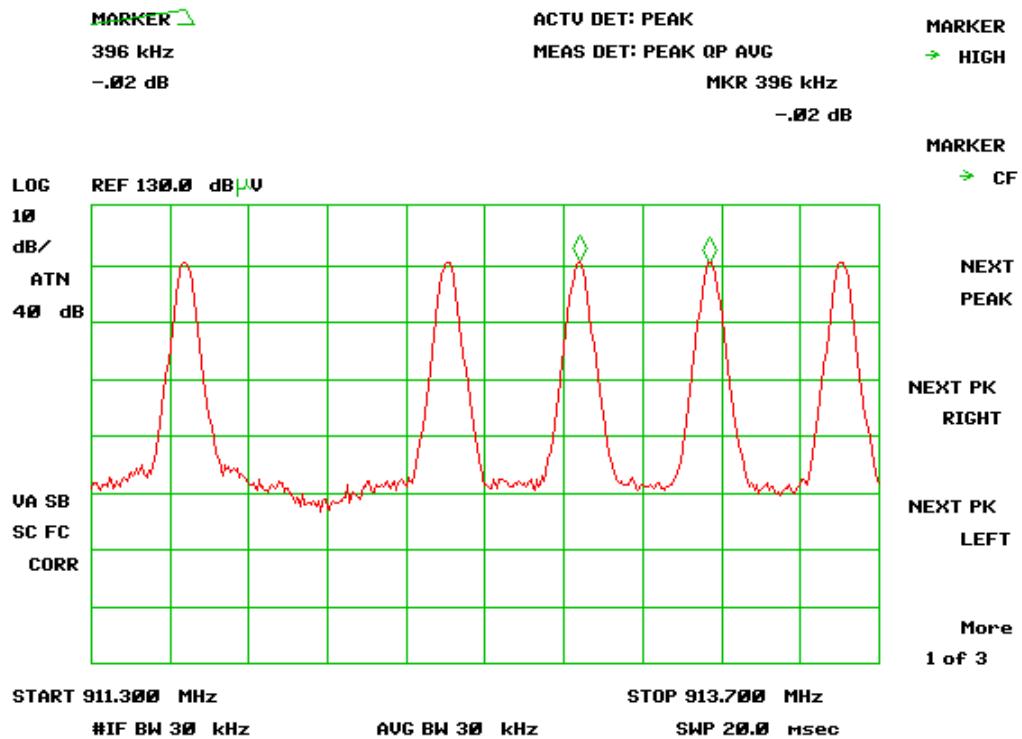
Client	Aztech Associates Inc	
Product	In-Home Display 900MHz Module	
Standard(s)	RSS 210 Issue 8:2010 / FCC Part 15 Subpart C 15:2010	

Minimum channel separation between Channels 18, 19, 20, 21, 22



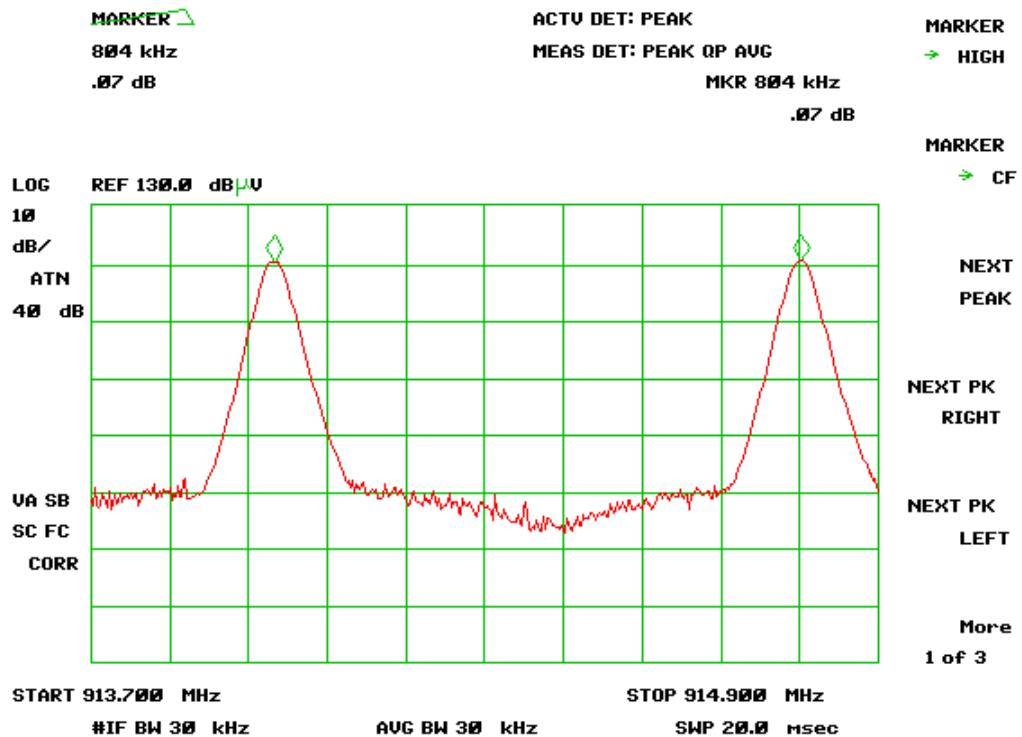
Client	Aztech Associates Inc	
Product	In-Home Display 900MHz Module	
Standard(s)	RSS 210 Issue 8:2010 / FCC Part 15 Subpart C 15:2010	

Minimum channel separation between Channels 23, 25, 26, 27, 28



Client	Aztech Associates Inc	
Product	In-Home Display 900MHz Module	
Standard(s)	RSS 210 Issue 8:2010 / FCC Part 15 Subpart C 15:2010	

Minimum channel separation between Channels 29, 31



Note: See 'Appendix B – EUT & Test Setup Photographs' for photos showing the test set-up.

Client	Aztech Associates Inc	
Product	In-Home Display 900MHz Module	
Standard(s)	RSS 210 Issue 8:2010 / FCC Part 15 Subpart C 15:2010	

## Test Equipment List

Equipment	Model No.	Manufacturer	Last calibration date	Next calibration due date	Asset #
Spectrum Analyzer	8566B	HP	Dec 21, 2011	Dec 21, 2013	GEMC 141
Attenuator 10 dB	FP-50-10	Trilithic	NCR	NCR	GEMC 42
RF Cable 1m	LMR-400-1M-50OHM-MN-MN	LexTec	NCR	NCR	GEMC 29

This report module is based on GEMC template "FCC – Power Line Conducted Emissions Class B\_Rev1"

Client	Aztech Associates Inc	
Product	In-Home Display 900MHz Module	
Standard(s)	RSS 210 Issue 8:2010 / FCC Part 15 Subpart C 15:2010	

## ***Number of Channels for Frequency Hopping Systems***

### **Purpose**

The purpose of this test is to ensure that the RF energy of frequency hopping systems is sufficiently spread over a spectrum and that the radio energy is not overly dense. This limit helps allow for other spread spectrum devices to co-exist in the same frequency spectrum. This also helps prevent corruption of data by ensuring adequate channel separation to distinguish the reception of the intended information.

### **Limits**

The limits are as defined in 47 CFR FCC Part 15 Section 15.247(a)(1)

	902 to 928 MHz	2.4 to 2.4835 GHz	5.275 to 5.85 GHz
No conditions	$\geq 50$ channels	$\geq 15$ channels	$\geq 75$ channels
If 20 dB BW exceeds 250 kHz	$\geq 25$ channels	$\geq 15$ channels	$\geq 75$ channels

### **Results**

The EUT passed this requirement. The bandwidth of the EUT is established as 337 kHz earlier in this report. All channels used are shown in the plots of the previous section of this report regarding channel carrier separation. This device occupies 25 channels in the allocation band of 902 to 928 MHz, meeting the requirements for the number of channels.

Client	Aztech Associates Inc	
Product	In-Home Display 900MHz Module	
Standard(s)	RSS 210 Issue 8:2010 / FCC Part 15 Subpart C 15:2010	

## Test Equipment List

Equipment	Model No.	Manufacturer	Last calibration date	Next calibration due date	Asset #
Spectrum Analyzer	8566B	HP	Dec 21, 2011	Dec 21, 2013	GEMC 141
Attenuator 10 dB	FP-50-10	Trilithic	NCR	NCR	GEMC 42
RF Cable 1m	LMR-400-1M-50OHM-MN-MN	LexTec	NCR	NCR	GEMC 29

This report module is based on GEMC template "FCC – Power Line Conducted Emissions Class B\_Rev1"

Client	Aztech Associates Inc
Product	In-Home Display 900MHz Module
Standard(s)	RSS 210 Issue 8:2010 / FCC Part 15 Subpart C 15:2010



## ***Time of Occupancy***

### **Purpose**

The purpose of this test is to ensure that the RF energy of frequency hopping systems is hopping at a minimum defined rate. This helps ensure sufficient time off to enable other frequency hopping devices to co-operate within this allocated band.

### **Limits**

For 902 – 928 MHz systems, the limits are as defined in 47 CFR FCC Part 15 Section 15.247(a)(1)(i).

For frequency hopping systems in 902 – 928 MHz, the average time of occupancy on a frequency shall not be greater than 0.4 seconds within a 10 second period.

### **Results**

The EUT passed the requirements. Within a 10s period, a channel is occupied for a maximum of 3 times, each time for 100ms. This gives a maximum occupancy time of 300ms within a 10s period, which is under the limit as required.

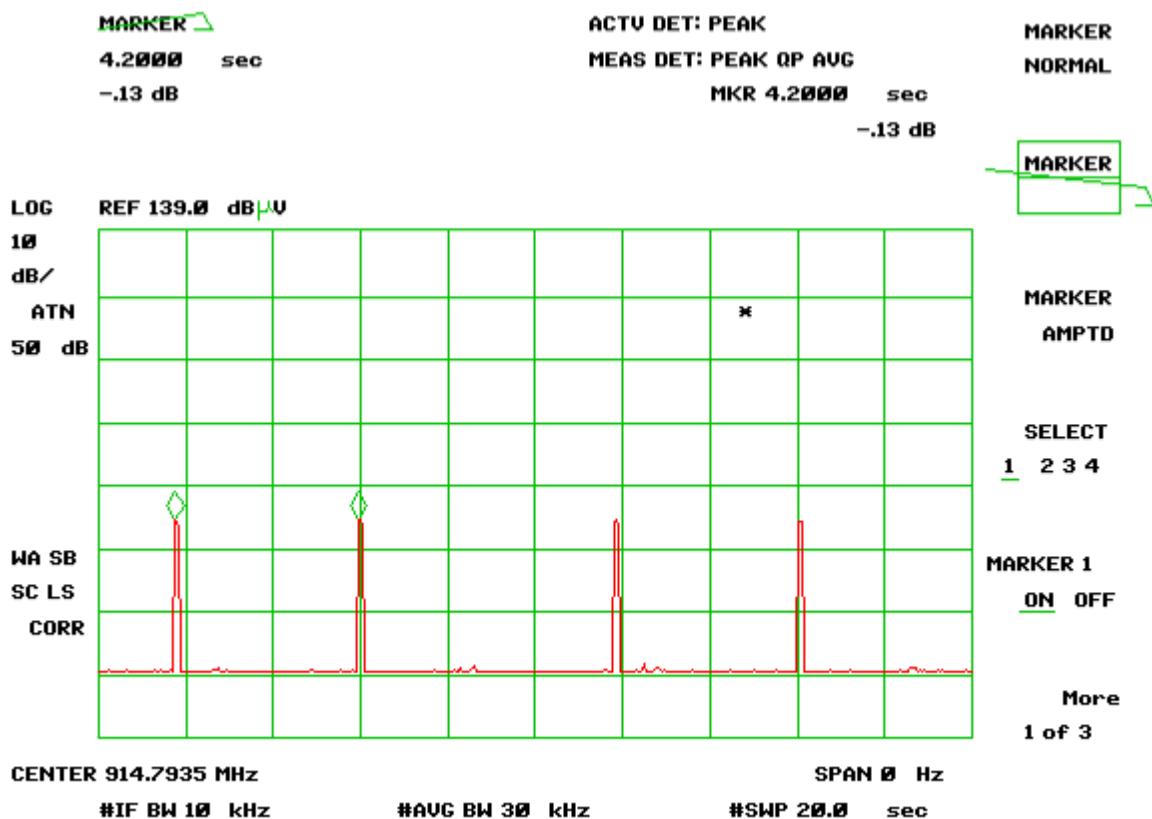
Client	Aztech Associates Inc
Product	In-Home Display 900MHz Module
Standard(s)	RSS 210 Issue 8:2010 / FCC Part 15 Subpart C 15:2010



## Graph(s)

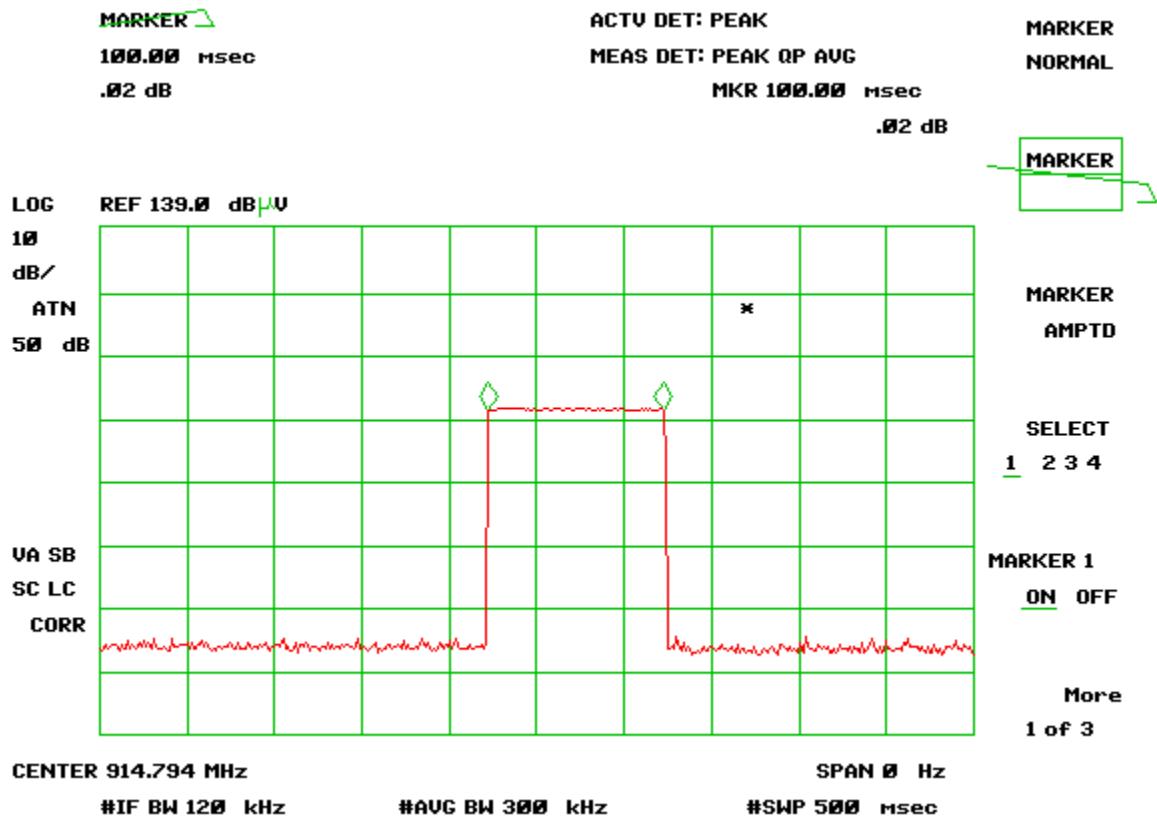
The first graph below shows the repeat time of the pseudorandom generated hopping list at a representative frequency. The second graph shows the on time.

Hopping repeat rate



Client	Aztech Associates Inc	
Product	In-Home Display 900MHz Module	
Standard(s)	RSS 210 Issue 8:2010 / FCC Part 15 Subpart C 15:2010	

On time during each channel



Note: See 'Appendix B – EUT & Test Setup Photographs' for photos showing the test set-up.

Client	Aztech Associates Inc	
Product	In-Home Display 900MHz Module	
Standard(s)	RSS 210 Issue 8:2010 / FCC Part 15 Subpart C 15:2010	

## Test Equipment List

Equipment	Model No.	Manufacturer	Last calibration date	Next calibration due date	Asset #
Spectrum Analyzer	8566B	HP	Dec 21, 2011	Dec 21, 2013	GEMC 141
Attenuator 10 dB	FP-50-10	Trilithic	NCR	NCR	GEMC 42
RF Cable 1m	LMR-400-1M-50OHM-MN-MN	LexTec	NCR	NCR	GEMC 29

This report module is based on GEMC template "FCC – Power Line Conducted Emissions Class B\_Rev1"

Client	Aztech Associates Inc
Product	In-Home Display 900MHz Module
Standard(s)	RSS 210 Issue 8:2010 / FCC Part 15 Subpart C 15:2010



## **Maximum Peak Envelope Conducted Power**

### **Purpose**

The purpose of this test is to ensure that the maximum power conducted to the radiating element does not exceed the limits specified. This ensures that if the end-user replaces the antenna, that the maximum power does not exceed an amount which may create an excessive power level.

### **Limits**

The limits are defined in FCC Part 15.247(b) and RSS 210.

For frequency hopping systems operating in the 902 - 928 MHz band employing less than 50 hopping channels but at least 25 hopping channels, the peak limit is 0.25 watts.

### **Results**

The EUT passed. The peak power measured was 23.3dBm (0.214mW).

Client	Aztech Associates Inc
Product	In-Home Display 900MHz Module
Standard(s)	RSS 210 Issue 8:2010 / FCC Part 15 Subpart C 15:2010



## Results

The EUT passes. The maximum output power is 0.214W, which is under the limit of 0.250W. The table below shows the peak power output of the device during the antenna conducted measurement while the EUT is in transmit operation. Note that there was 10 dB of external attenuation during this measurement, and has been accounted for in the calculations.

Conducted Power

Channel	Frequency (MHz)	Received (dBm)	External Attenuation (dB)	Output Power (dBm)	Output Power (W)
1 (Low)	902.8	13.28	10	23.28	0.213
16 (Middle)	908.8	13.08	10	23.08	0.204
31 (High)	914.8	13.30	10	23.30	0.214

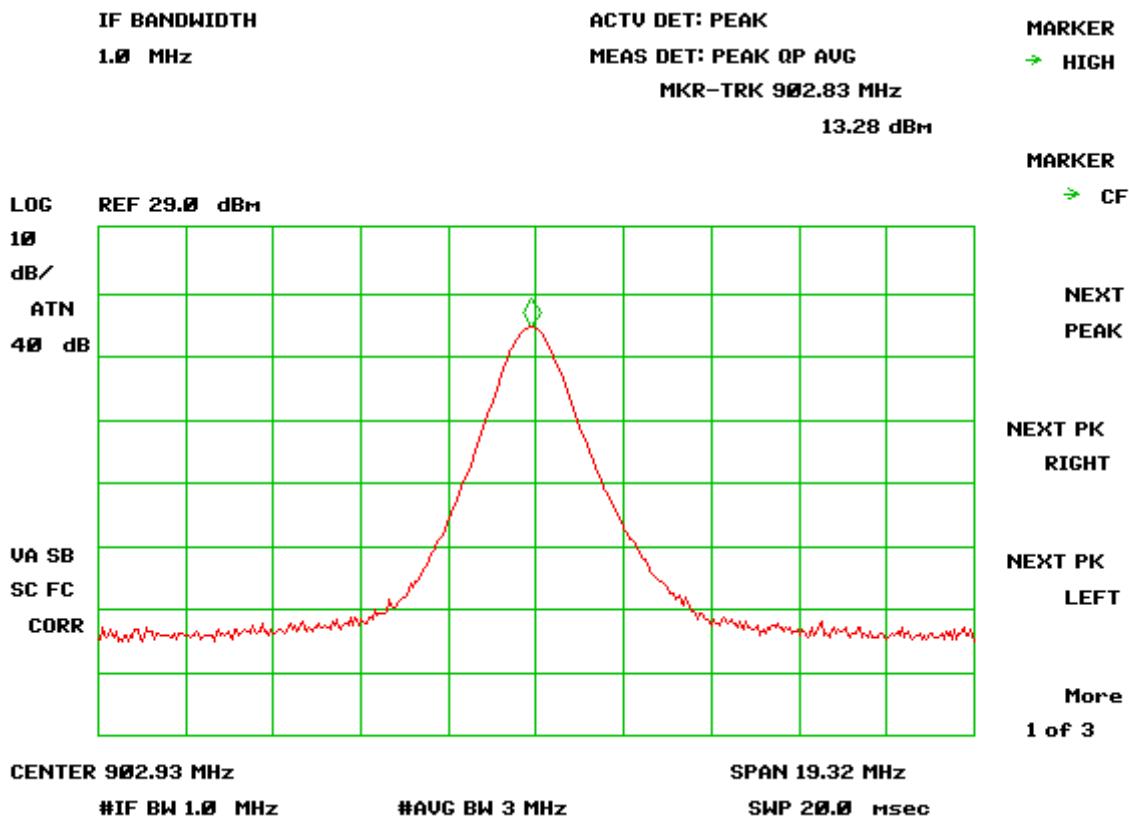
The calculated value is:

$$\text{Received (dBm)} + \text{External Attenuation (dB)} = \text{Output Power (dBm)}$$

$$10^{(\text{Output Power (dBm)}/10)} = \text{Output Power (W)}$$

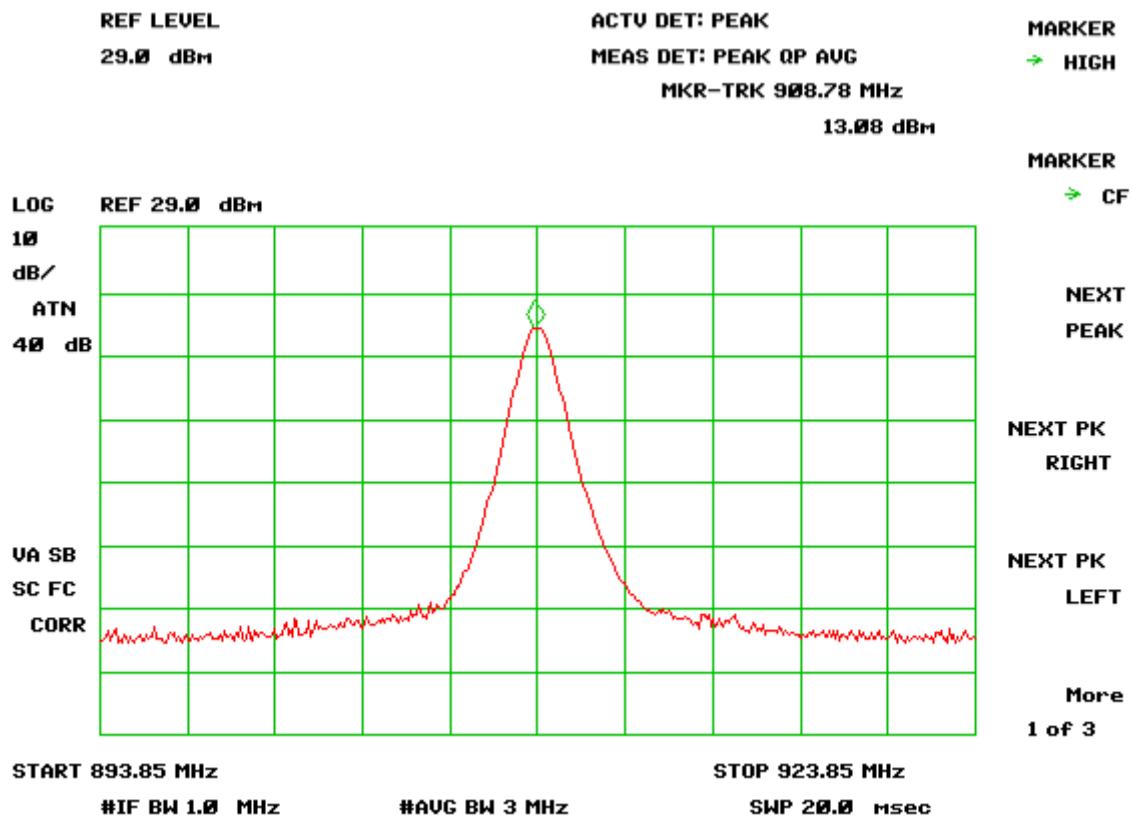
Client	Aztech Associates Inc	
Product	In-Home Display 900MHz Module	
Standard(s)	RSS 210 Issue 8:2010 / FCC Part 15 Subpart C 15:2010	

Low channel



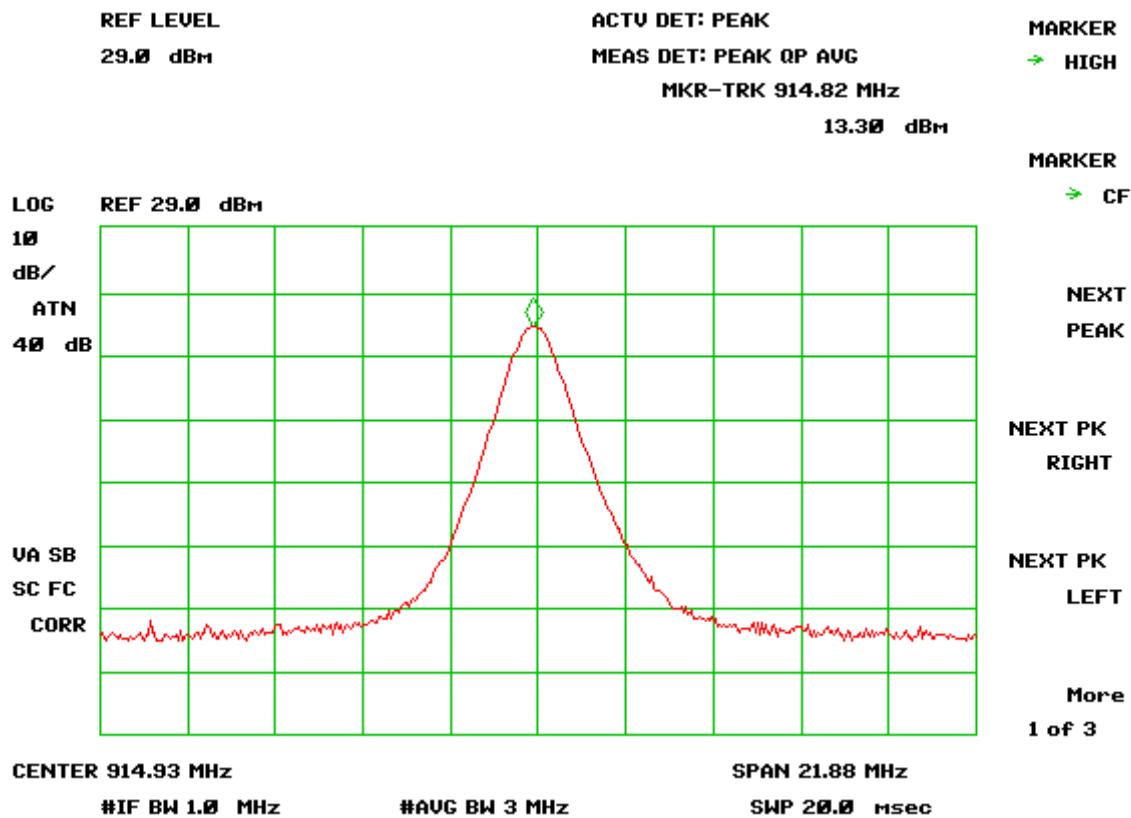
Client	Aztech Associates Inc	
Product	In-Home Display 900MHz Module	
Standard(s)	RSS 210 Issue 8:2010 / FCC Part 15 Subpart C 15:2010	

Middle channel



Client	Aztech Associates Inc	
Product	In-Home Display 900MHz Module	
Standard(s)	RSS 210 Issue 8:2010 / FCC Part 15 Subpart C 15:2010	

## High Channel



Note: See 'Appendix B – EUT & Test Setup Photographs' for photos showing the test set-up.

Client	Aztech Associates Inc	
Product	In-Home Display 900MHz Module	
Standard(s)	RSS 210 Issue 8:2010 / FCC Part 15 Subpart C 15:2010	

## Test Equipment List

Equipment	Model No.	Manufacturer	Last calibration date	Next calibration due date	Asset #
Spectrum Analyzer	8566B	HP	Dec 21, 2011	Dec 21, 2013	GEMC 141
Attenuator 10 dB	FP-50-10	Trilithic	NCR	NCR	GEMC 42
RF Cable 1m	LMR-400-1M-50OHM-MN-MN	LexTec	NCR	NCR	GEMC 29

This report module is based on GEMC template "FCC – Power Line Conducted Emissions Class B\_Rev1"

Client	Aztech Associates Inc
Product	In-Home Display 900MHz Module
Standard(s)	RSS 210 Issue 8:2010 / FCC Part 15 Subpart C 15:2010



## ***Spurious Conducted Emissions***

### **Purpose**

The purpose of this test is to ensure that the maximum power conducted to the radiating element at frequencies outside of the authorized spectrum does not exceed the limits specified. This ensures that the only the intended signal is delivered to the radiating element.

### **Limits**

The limits are defined in 15.247(d). In any 100 kHz band, the peak spurious harmonics emissions must be at least 20 dB below the fundamental. Spurious Conducted emissions are to be evaluated up to the 10<sup>th</sup> harmonic.

### **Results**

The EUT passes. Low, middle and high band was measured. The worst case is presented as a graph for the spectrum. The -20 dBc requirement is shown.

Client	Aztech Associates Inc	
Product	In-Home Display 900MHz Module	
Standard(s)	RSS 210 Issue 8:2010 / FCC Part 15 Subpart C 15:2010	

## Graph(s)

The graphs shown below shows the peak power output of the device during the antenna conducted measurement during transmit operation of the EUT. Note there was 10 dB of external attenuation taken during this measurement. All frequencies are >20dB below the fundamental.

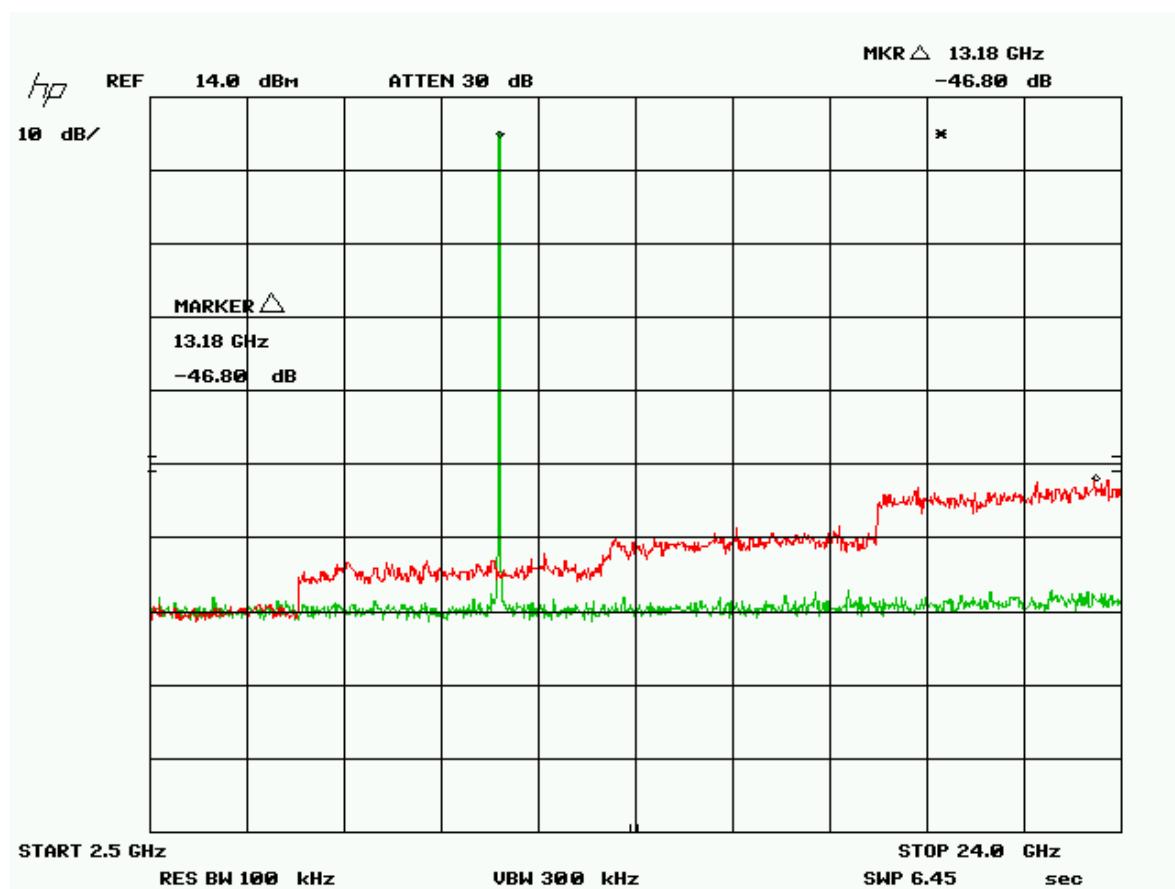
Low Channel

9kHz – 2.5GHz plot is overlaid on 2.5GHz – 24GHz plot

Green trace (showing fundamental) spans 9kHz – 2.5GHz

Red trace spans 2.5GHz – 24GHz

RBW = 100kHz

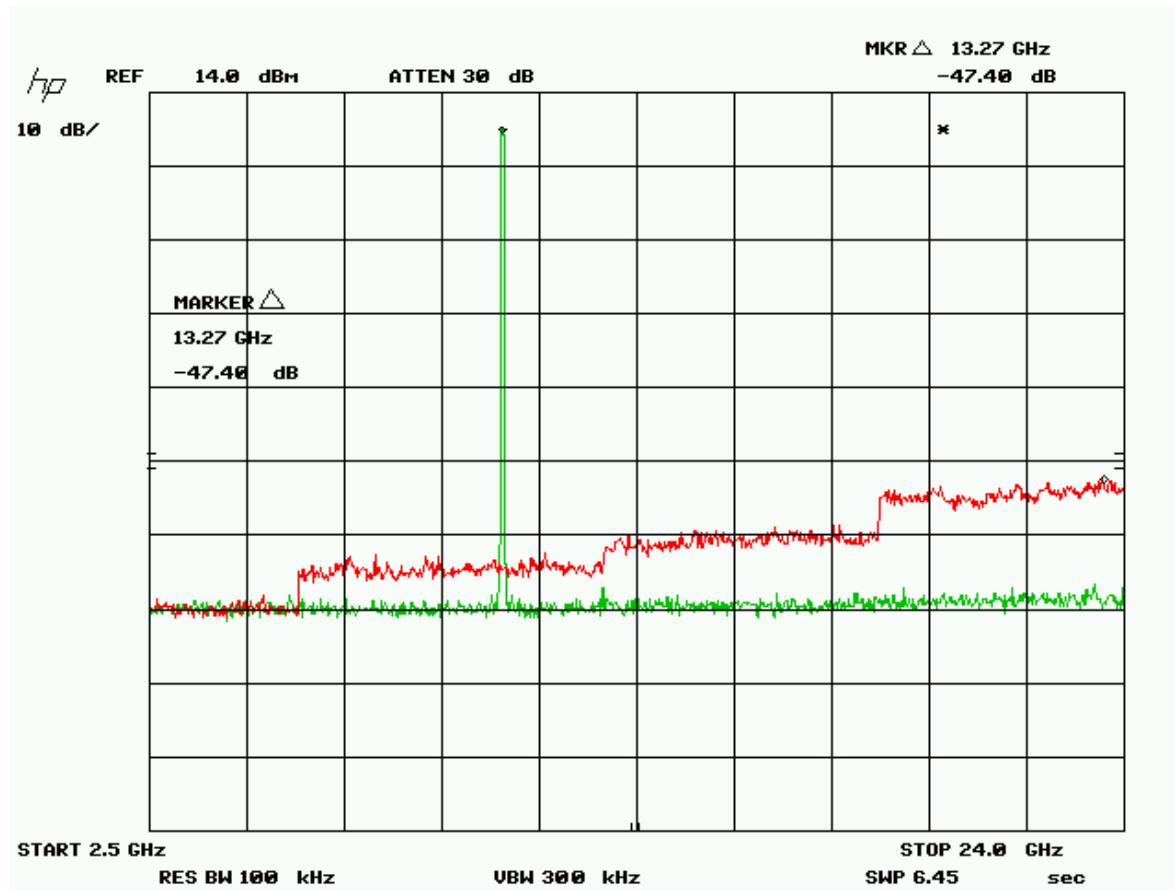


Client	Aztech Associates Inc
Product	In-Home Display 900MHz Module
Standard(s)	RSS 210 Issue 8:2010 / FCC Part 15 Subpart C 15:2010



### Middle Channel

9kHz – 2.5GHz plot overlaid on 2.5GHz – 24GHz plot  
 Green trace (showing fundamental) spans 9kHz – 2.5GHz  
 Red trace spans 2.5GHz – 24GHz  
 RBW = 100kHz

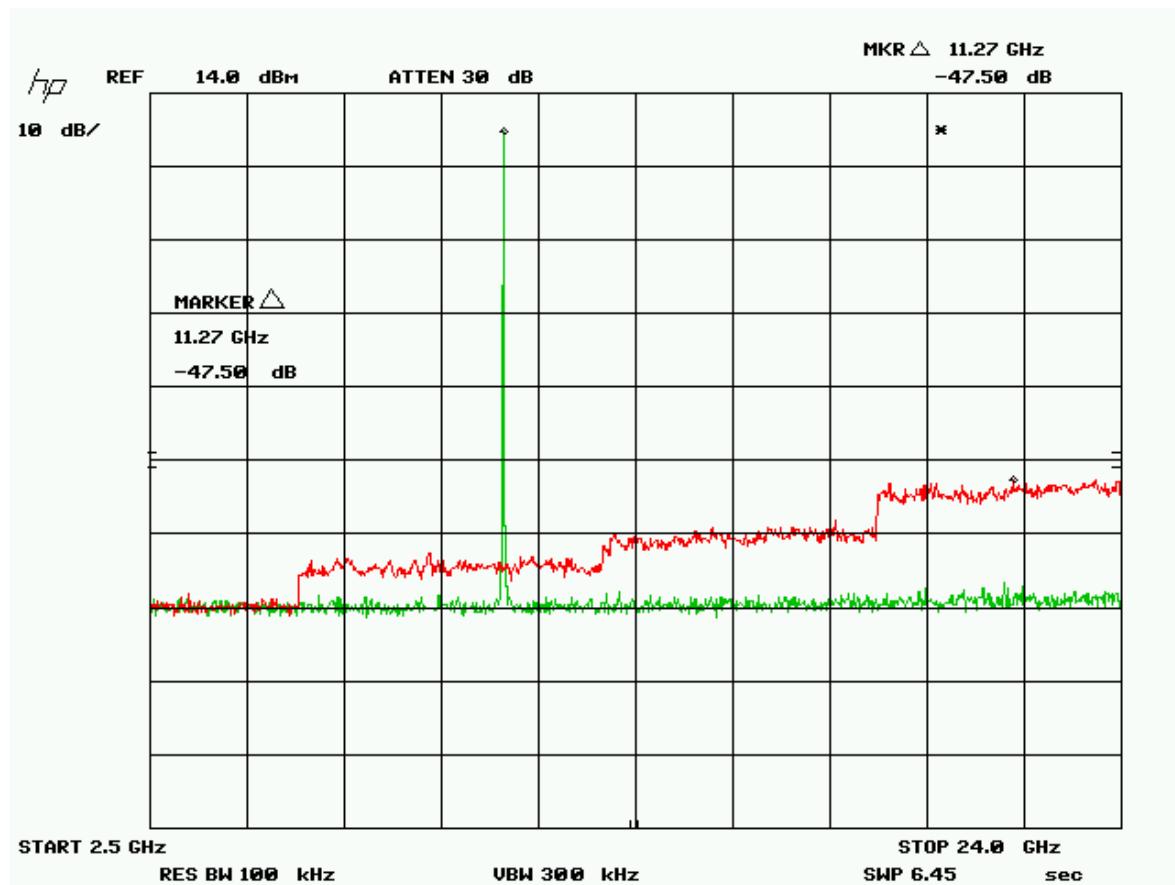


Client	Aztech Associates Inc
Product	In-Home Display 900MHz Module
Standard(s)	RSS 210 Issue 8:2010 / FCC Part 15 Subpart C 15:2010



### High Channel

9kHz – 2.5GHz plot overlaid on 2.5GHz – 24GHz plot  
 Green trace (showing fundamental) spans 9kHz – 2.5GHz  
 Red trace spans 2.5GHz – 24GHz  
 RBW = 100kHz



Note: See 'Appendix B – EUT & Test Setup Photographs' for photos showing the test set-up.

Client	Aztech Associates Inc	
Product	In-Home Display 900MHz Module	
Standard(s)	RSS 210 Issue 8:2010 / FCC Part 15 Subpart C 15:2010	

## Test Equipment List

Equipment	Model No.	Manufacturer	Last calibration date	Next calibration due date	Asset #
Spectrum Analyzer	8566B	HP	Dec 21, 2011	Dec 21, 2013	GEMC 141
Attenuator 10 dB	FP-50-10	Trilithic	NCR	NCR	GEMC 42
RF Cable 1m	LMR-400-1M-50OHM-MN-MN	LexTec	NCR	NCR	GEMC 29

This report module is based on GEMC template "FCC – Power Line Conducted Emissions Class B\_Rev1"

Client	Aztech Associates Inc
Product	In-Home Display 900MHz Module
Standard(s)	RSS 210 Issue 8:2010 / FCC Part 15 Subpart C 15:2010



## ***Maximum Permissible Exposure***

### **Purpose**

The purpose of this test is to ensure that the RF energy intentionally transmitted, in terms of power density emitted from the EUT at a stated operating distance does not exceed the limits listed below as defined in the applicable test standard, as calculated based upon readings obtained during testing. This helps protect human exposure to excessive RF fields.

### **Limit(s) and Method**

The limits, as defined in FCC 15.247(i), and FCC 1.1310 Table 1 (B), Limits for General Population/Uncontrolled Exposure, was applied. The limit for the frequency range of 300 MHz to 1500 MHz was applied. This is a limit of  $f/1500 \text{ mW/cm}^2$ , where  $f$  = frequency in MHz. The EUT is to be used at a minimum distance of greater than 10cm from the user during normal operation. However, 10cm was used as the distance for calculations as a worst case scenario.

Client	Aztech Associates Inc
Product	In-Home Display 900MHz Module
Standard(s)	RSS 210 Issue 8:2010 / FCC Part 15 Subpart C 15:2010



## Results

The EUT passed the requirements. The worst case calculated power density was 0.0103 mW/cm<sup>2</sup>, this is significantly under the 1.0 mW/cm<sup>2</sup> requirement.

## Calculations

Maximum received radiated power at 3m distance = 106.3dBuV - 95.2dB = 11.1dBm

P<sub>t</sub> = Maximum received conducted output power to antenna = 23.3dBm = 214mW

G = Antenna gain = 11.1dBm - 23.3dBm = -12.2dBi = 0.0603 (numerically)

$$\text{Power Density} = P_d = (P_t * G) / (4 * \pi * R^2)$$

R = 10 cm

$$P_d = (214 \text{ mW} * 0.0603) / (4 * \pi * 10^2 \text{ cm}^2)$$

$$P_d = 12.90 \text{ mW} / 1256.6 \text{ cm}^2$$

$$P_d = 0.0103 \text{ mW/cm}^2$$

Client	Aztech Associates Inc	
Product	In-Home Display 900MHz Module	
Standard(s)	RSS 210 Issue 8:2010 / FCC Part 15 Subpart C 15:2010	

## ***Power Line Conducted Emissions***

### **Purpose**

The purpose of this test is to ensure that the RF energy unintentionally emitted from the EUT's power line when connected does not exceed the limits listed below as defined in the applicable test standard, as measured from a LISN. This helps protect lower frequency radio services such as AM radio, shortwave radio, amateur radio operators, maritime radio, CB radio, and so on, from unwanted interference.

### **Limits & Method**

The limits are as defined in 47 CFR FCC Part 15 Section 15.207

Method is as defined in ANSI C64:2003

Average Limits		QuasiPeak Limits	
150 kHz – 500 kHz	56 to 46 dBuV	150 kHz – 500 kHz	66 to 56 dBuV
500 kHz – 5 MHz	46 dBuV	500 kHz – 5 MHz	56 dBuV
5 MHz – 30 MHz	50 dBuV	500 kHz – 30 MHz	60 dBuV

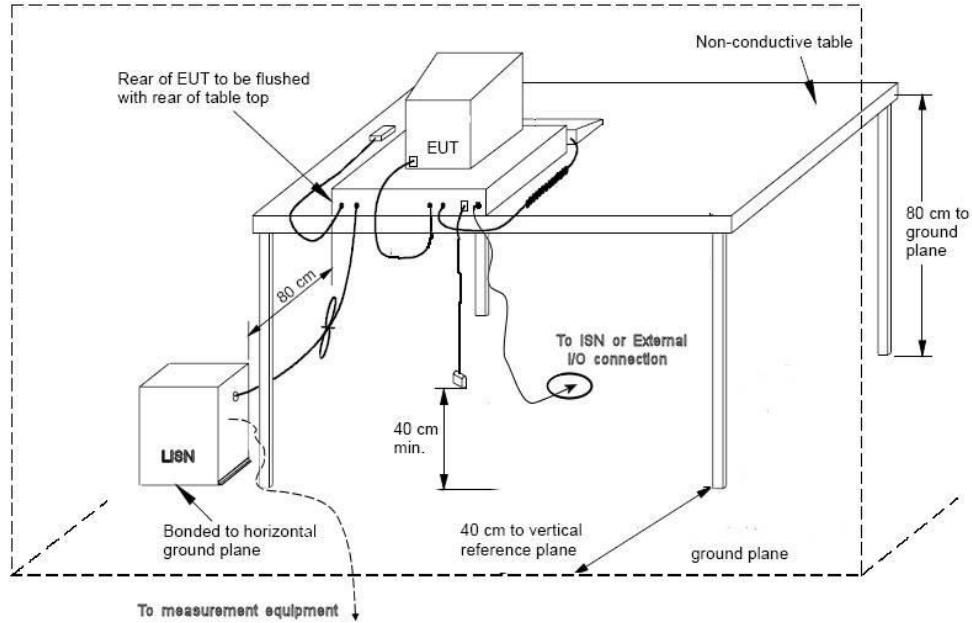
The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.50 MHz.

Note: If the Peak or Quasi Peak detector measurements do not exceed the Average limits, then the EUT is deemed to have passed the requirements.

Both limits are applicable, and each is specified as being measured with a 9 kHz measurement bandwidth.

Client	Aztech Associates Inc	
Product	In-Home Display 900MHz Module	
Standard(s)	RSS 210 Issue 8:2010 / FCC Part 15 Subpart C 15:2010	 The logo for Global EMC Inc. It features a stylized globe with red and blue lines representing latitude and longitude. Overlaid on the globe is the word "GLOBAL" in a blue, bold, sans-serif font, with a small blue star above the letter "A". Below the globe, the words "EMC INC" are written in a large, bold, blue, blocky font.

## Typical Setup Diagram



## Measurement Uncertainty

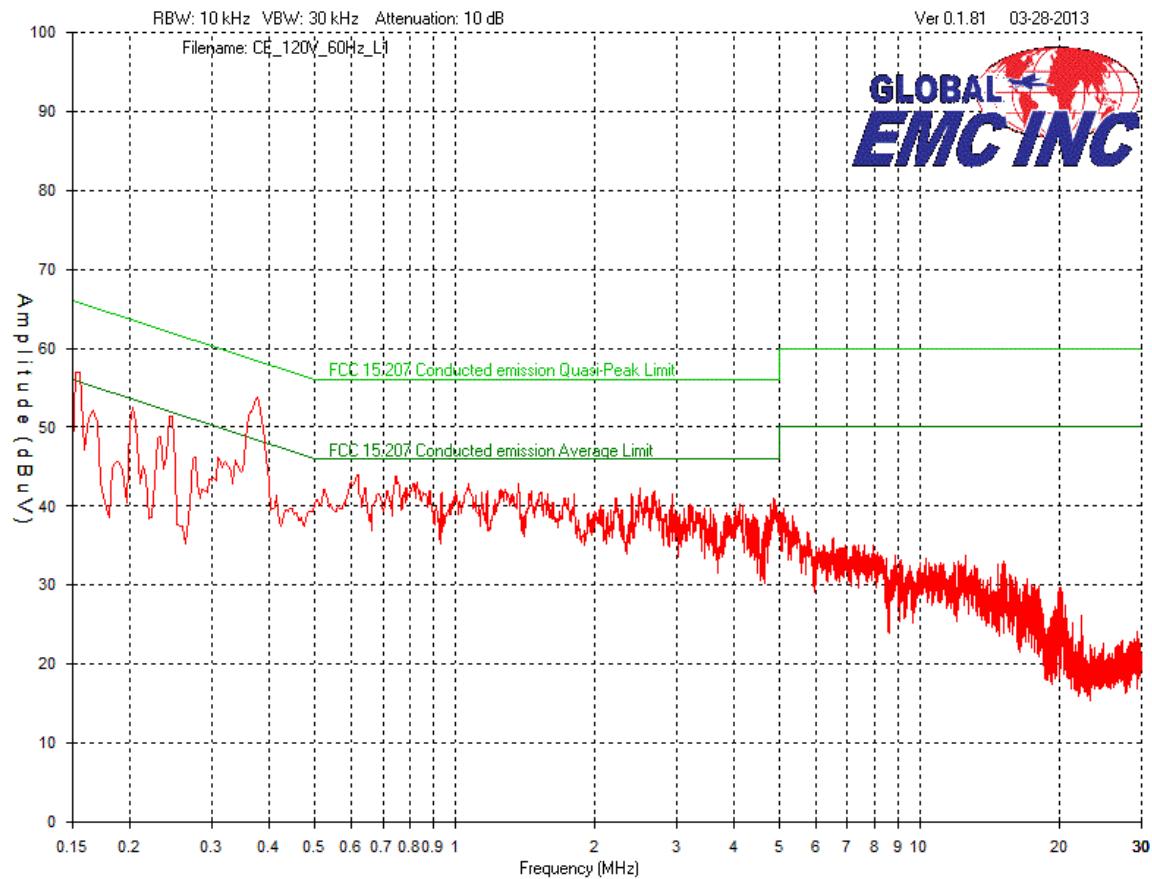
The expanded measurement uncertainty is calculated in accordance with CISPR 16-4-2 and is +/-3.6 dB with a 'k=2' coverage factor and a 95% confidence level.

## Preliminary Graphs

Note the graphs shown below are for graphical illustration only. For final measurements with the appropriate detector where applicable, please refer to the table. The graphs shown below are peak measurement graphs, measured with a resolution bandwidth greater than or equal to the final required detector. These graphs are performed as a worst case measurement to enable the detection of frequencies of concern and for considerable time savings.

Client	Aztech Associates Inc	
Product	In-Home Display 900MHz Module	
Standard(s)	RSS 210 Issue 8:2010 / FCC Part 15 Subpart C 15:2010	

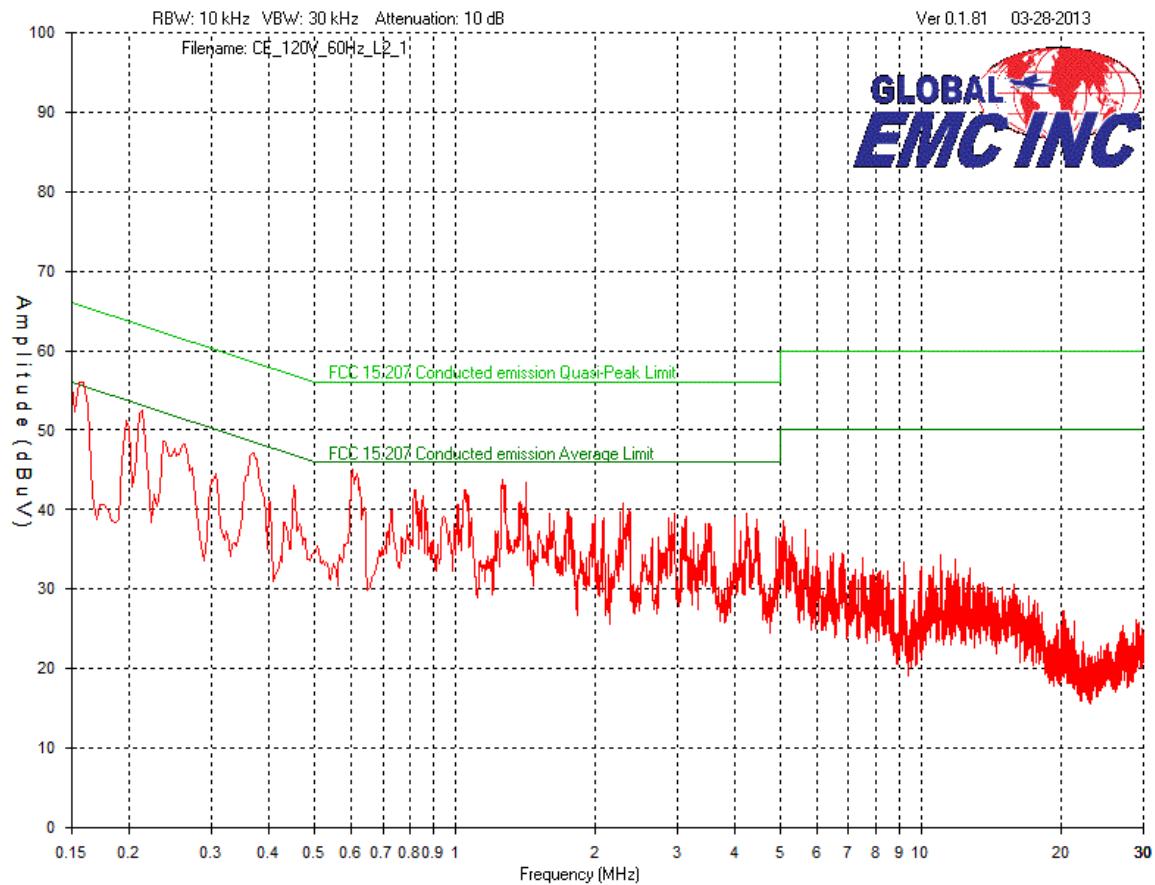
Phase Line  
120V, 60Hz



Client	Aztech Associates Inc
Product	In-Home Display 900MHz Module
Standard(s)	RSS 210 Issue 8:2010 / FCC Part 15 Subpart C 15:2010



Neutral Line  
120V, 60Hz



Client	Aztech Associates Inc
Product	In-Home Display 900MHz Module
Standard(s)	RSS 210 Issue 8:2010 / FCC Part 15 Subpart C 15:2010



## Final Measurements

Top 6 measurements

Test Frequency (MHz)	Detector	Received signal (dB $\mu$ V)	Attenuator (dB)	Cable loss (dB)	LISN Voltage factor (dB)	Emission Level (dB $\mu$ V)	Emission limit (dB $\mu$ V) Quasi-Peak	Emission limit (dB $\mu$ V) Average	Margin (dB) Quasi-Peak	Margin (dB) Average	Result
<b>Phase Line</b>											
0.370	Peak	43.4	10	0.1	0.3	53.8	58.4	---	4.6	---	Pass
0.370	Avg.	33.17	10	0.1	0.3	43.57	---	48.4	---	4.83	Pass
0.153	Peak	45.5	10	0.1	1.5	57.1	65.8	---	8.7	---	Pass
0.153	Avg.	21.46	10	0.1	1.5	33.06	---	55.8	---	22.74	Pass
0.243	Peak	40.4	10	0.1	0.8	51.3	62	---	10.7	---	Pass
0.243	Avg.	17.53	10	0.1	0.8	28.43	---	52	---	23.57	Pass
0.203	Peak	41.4	10	0.1	1	52.5	63.5	---	11	---	Pass
0.203	Avg.	19.66	10	0.1	1	30.76	---	53.5	---	22.74	Pass
0.615	Peak	33.7	10	0.1	0.2	44	56	46	12	2	Pass
0.748	Peak	33.6	10	0.1	0.2	43.9	56	46	12.1	2.1	Pass
<b>Neutral Line</b>											
0.160	Peak	44.5	10	0.1	1.4	56	65.5	---	9.5	---	Pass
0.160	Avg.	20.61	10	0.1	1.4	32.11	---	55.5	---	23.39	Pass
0.213	Peak	41.4	10	0.1	0.9	52.4	63.1	---	10.7	---	Pass
0.213	Avg.	16.77	10	0.1	0.9	27.77	---	53.1	---	25.33	Pass
0.602	Peak	34.7	10	0.1	0.2	45	56	---	11	---	Pass
0.602	Avg.	19.2	10	0.1	0.2	29.5	---	46	---	16.5	Pass
0.369	Peak	36.6	10	0.1	0.3	47	58.5	---	11.5	---	Pass
0.369	Avg.	28.54	10	0.1	0.3	38.94	---	48.5	---	9.56	Pass
1.26	Peak	33.4	10	0.1	0.2	43.7	56	46	12.3	2.3	Pass
1.42	Peak	33.2	10	0.1	0.2	43.5	56	46	12.5	2.5	Pass

Notes:

Where peak readings are under quasi-peak and/or average limits, the EUT passes the respective requirements.

Avg. = Average reading

QP = Quasi-Peak reading

Client	Aztech Associates Inc	
Product	In-Home Display 900MHz Module	
Standard(s)	RSS 210 Issue 8:2010 / FCC Part 15 Subpart C 15:2010	

See 'Appendix B – EUT & Test Setup Photographs' for photos showing the test set-up for the highest line conducted emission

## Test Equipment List

Equipment	Model No.	Manufacturer	Last calibration date	Next calibration due date	Asset #
Spectrum Analyzer	ESL 6	Rohde & Schwarz	Oct. 26, 2011	Oct. 26, 2013	GEMC 160
LISN	FCC-LISN-50/250-16-2-01	FCC	Feb. 6, 2013	Feb. 6, 2015	GEMC 65
RF Cable 7m	LMR-400-7M-50OHM-MN-MN	LexTec	NCR	NCR	GEMC 28
RF Cable 1m	LMR-400-1M-50OHM-MN-MN	LexTec	NCR	NCR	GEMC 29
Attenuator 10 dB	FP-50-10	Trilithic	NCR	NCR	GEMC 42

This report module is based on GEMC template "FCC – Power Line Conducted Emissions Class B\_Rev1"

Client	Aztech Associates Inc	
Product	In-Home Display 900MHz Module	
Standard(s)	RSS 210 Issue 8:2010 / FCC Part 15 Subpart C 15:2010	

## Appendix A – EUT Summary

For further details for filing purposes, refer to filing package.

### General EUT Description

Client Details	
Organization / Address	Aztech Associates Inc. 805 Bayridge Dr. Kingston, On K7P 1T5
Contact	Carlos Vicente
Phone	1-613-384-9400
Email	carlos@aztechinc.com
EUT (Equipment Under Test) Details	
EUT Name	In-Home Display 900MHz Module
EUT revision	80
Software version	2.0
Input voltage	5 VDC
Rated input current (A)	.75
Nominal power consumption (W)	.25
Number of power supplies in EUT	1
Transmits RF energy?	Yes 902-928MHz range
Basic EUT functionality description	Communicates information from metering devices
Frequency of all clocks present in EUT	32.768kHz, 8MHz, 12MHz, 26.1688889MHz, 48MHz,
Available connectors on EUT	USB micro
Peripherals required to exercise EUT	Programs using PC through USB port
Dimensions of product	L 90mm W 30mm H 80mm

Note: The EUT is considered to have been received the date of the commencement of the first test, unless otherwise stated. For a close-up picture of the EUT, see 'Appendix B – EUT & Test Setup Photographs'.

Client	Aztech Associates Inc
Product	In-Home Display 900MHz Module
Standard(s)	RSS 210 Issue 8:2010 / FCC Part 15 Subpart C 15:2010

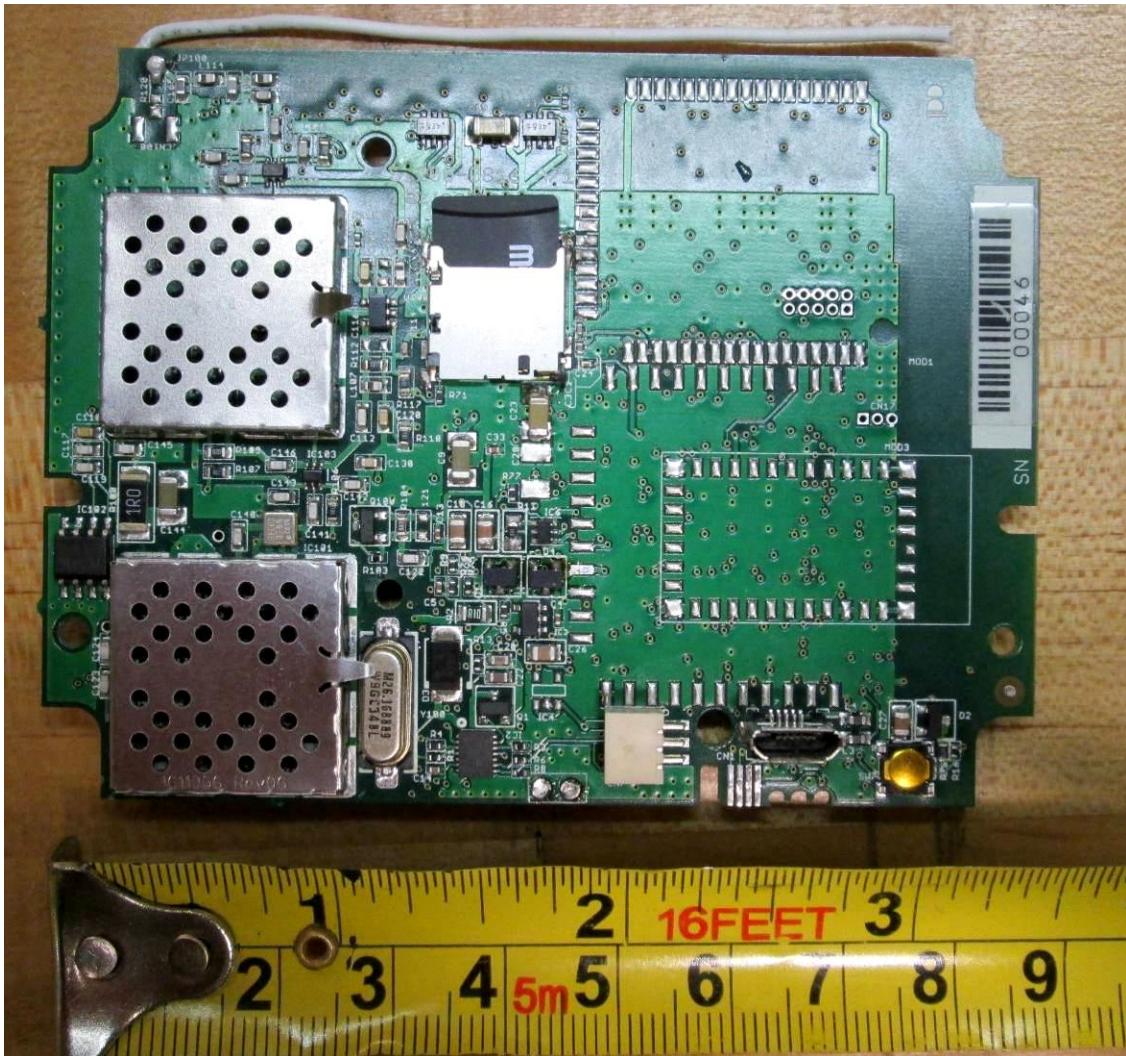


## Appendix B – EUT and Test Setup Photographs

These photos are for information purposes only.  
 Also refer to photo documents that are separate from this test report.

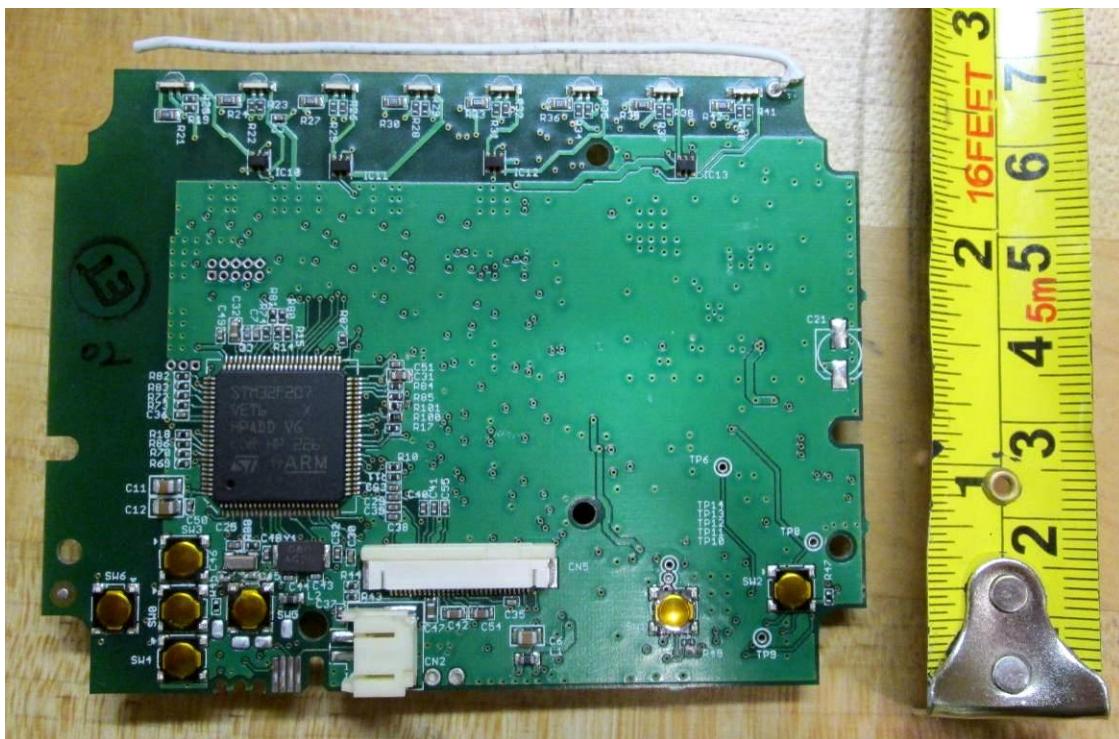
Client	Aztech Associates Inc	
Product	In-Home Display 900MHz Module	
Standard(s)	RSS 210 Issue 8:2010 / FCC Part 15 Subpart C 15:2010	

EUT – External view, side 1



Client	Aztech Associates Inc	
Product	In-Home Display 900MHz Module	
Standard(s)	RSS 210 Issue 8:2010 / FCC Part 15 Subpart C 15:2010	

EUT – External view, side 2



Client	Aztech Associates Inc
Product	In-Home Display 900MHz Module
Standard(s)	RSS 210 Issue 8:2010 / FCC Part 15 Subpart C 15:2010



## Radiated Emissions 1



Client	Aztech Associates Inc
Product	In-Home Display 900MHz Module
Standard(s)	RSS 210 Issue 8:2010 / FCC Part 15 Subpart C 15:2010



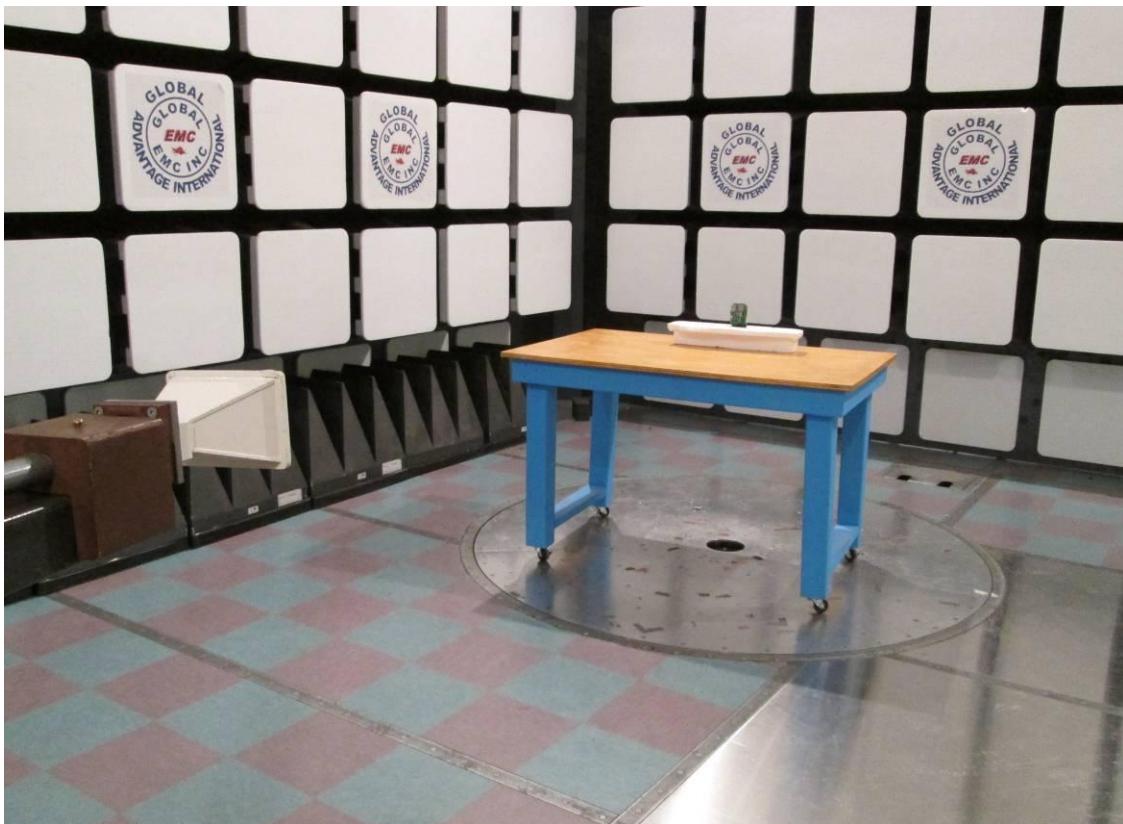
## Radiated Emissions 2



Client	Aztech Associates Inc
Product	In-Home Display 900MHz Module
Standard(s)	RSS 210 Issue 8:2010 / FCC Part 15 Subpart C 15:2010



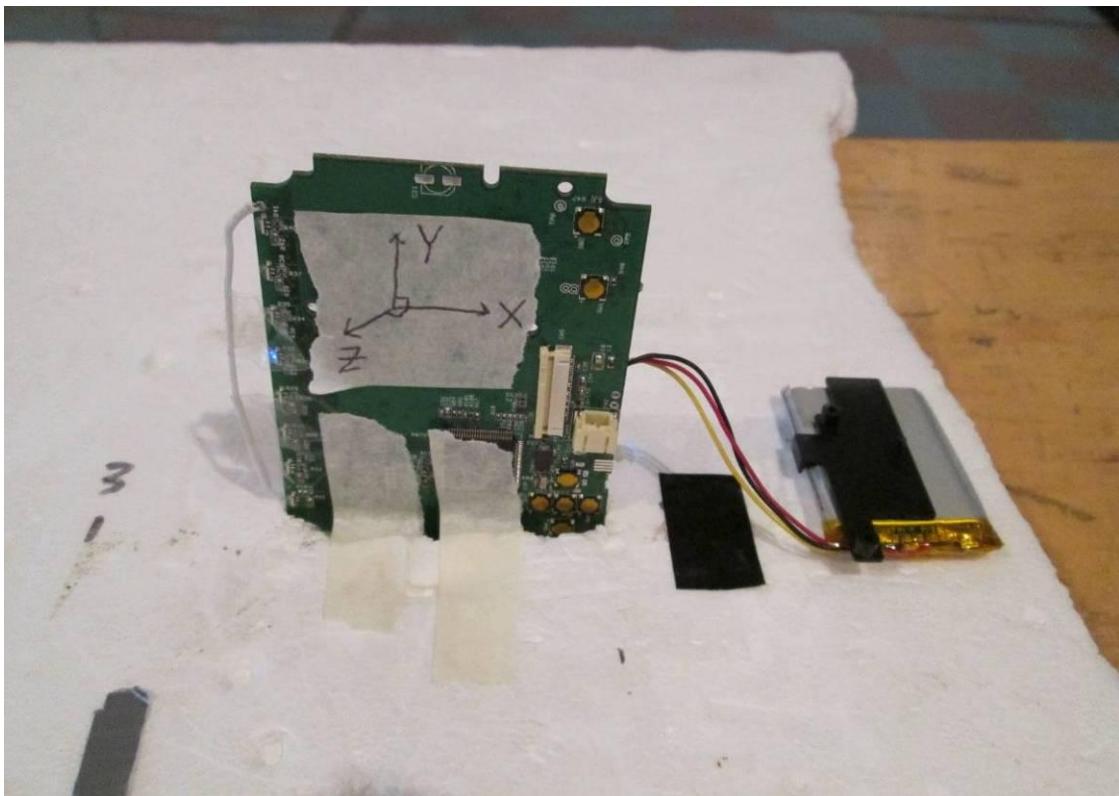
### Radiated Emissions 3



Client	Aztech Associates Inc
Product	In-Home Display 900MHz Module
Standard(s)	RSS 210 Issue 8:2010 / FCC Part 15 Subpart C 15:2010

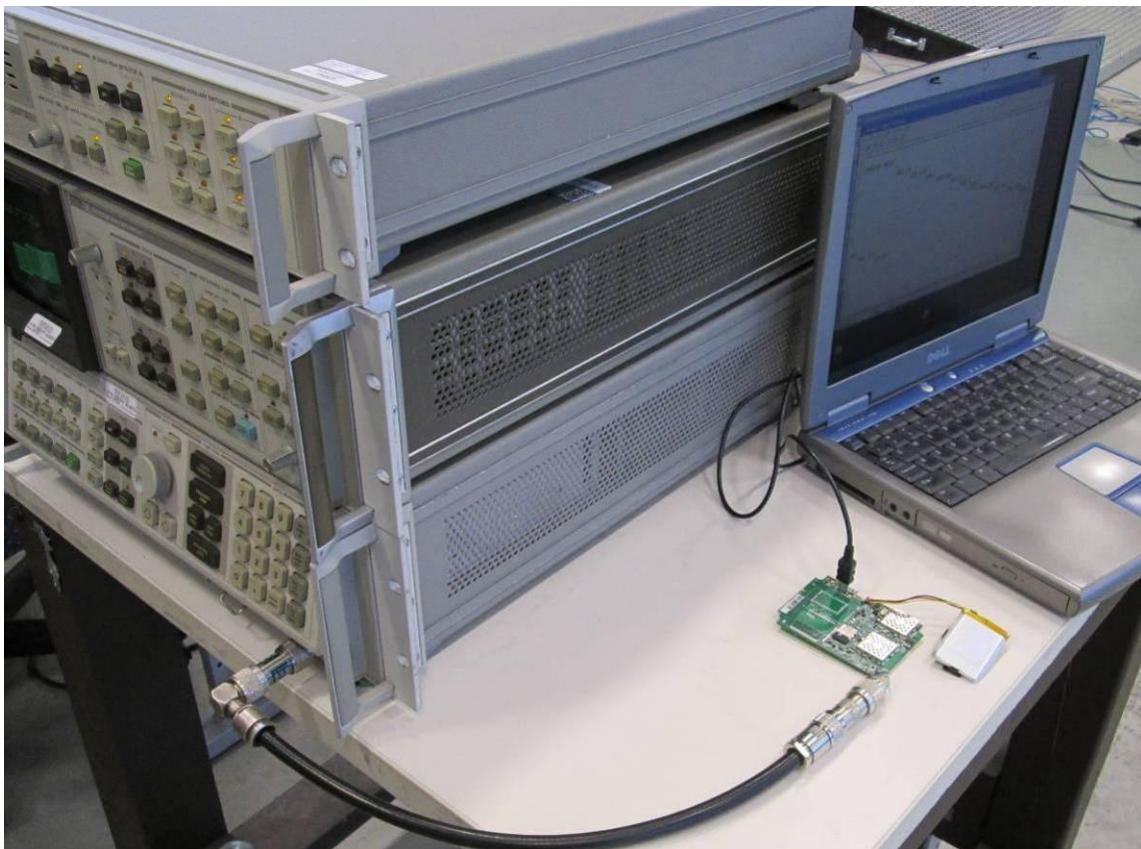
The logo for Global EMC Inc. It features the word "GLOBAL" in blue capital letters above a red globe. The globe has a white star in the upper left quadrant. Below the globe, the words "EMC INC" are written in large blue capital letters.

Radiated Emissions – Close up (worst case EUT configuration)



Client	Aztech Associates Inc	
Product	In-Home Display 900MHz Module	
Standard(s)	RSS 210 Issue 8:2010 / FCC Part 15 Subpart C 15:2010	

## Antenna Conducted Measurements



Client	Aztech Associates Inc
Product	In-Home Display 900MHz Module
Standard(s)	RSS 210 Issue 8:2010 / FCC Part 15 Subpart C 15:2010

The logo for Global EMC Inc. It features the word "GLOBAL" in blue capital letters at the top, a red globe graphic with a white star in the upper right, and the words "EMC INC" in large blue capital letters at the bottom.

## Conducted Emissions

